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Research Report 1442

**Review of U.S. Armor Crew and Platoon Training
in Preparation for the 1985 Canadian Army
Trophy (CAT) Competition**

Barbara A. Black and Millicent H. Abel



**ARI Field Unit at Fort Knox, Kentucky
Training Research Laboratory**



U. S. Army

**Research Institute for the Behavioral and Social Sciences
May 1987**

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UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

ADA185470

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY --		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE --		5. MONITORING ORGANIZATION REPORT NUMBER(S) --	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) ARI Research Report 1442		6a. NAME OF PERFORMING ORGANIZATION U.S. Army Research Institute Field Unit--Fort Knox	
6b. OFFICE SYMBOL (If applicable) PERI-IK		7a. NAME OF MONITORING ORGANIZATION U.S. Army Research Institute for the Behavioral and Social Sciences	
6c. ADDRESS (City, State, and ZIP Code) Steele Hall Fort Knox, KY 40121-5620		7b. ADDRESS (City, State, and ZIP Code) 5001 Eisenhower Avenue Alexandria, VA 22333-5600	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION --		8b. OFFICE SYMBOL (If applicable) --	
8c. ADDRESS (City, State, and ZIP Code) --		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER --	
10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 637.44.A		PROJECT NO. 2Q26374-4A795	TASK NO. 3.5.1
11. TITLE (Include Security Classification) Review of U.S. Armor Crew and Platoon Training in Preparation for the 1985 Canadian Army Trophy (CAT) Competition		WORK UNIT ACCESSION NO. 3.5.1.H.3	
12. PERSONAL AUTHOR(S) Barbara A. Black and Millicent H. Abel		13a. TYPE OF REPORT Final Report	
13b. TIME COVERED FROM 7/85 TO 12/86		14. DATE OF REPORT (Year, Month, Day) May 1987	
15. PAGE COUNT 76		16. SUPPLEMENTARY NOTATION --	
17. COSATI CODES FIELD GROUP SUB-GROUP		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) Armor Armed Services Vocational Aptitude Battery (ASVAB) Tank gunnery (continued)	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Three U.S. Armor units participated in the 1985 Canadian Army Trophy (CAT) competition. This competition provided a unique opportunity to evaluate tank gunnery training strategies and crew selection practices. The results of analyses comparing performance in training with performance in the competition and the results of interviews with unit cadre are presented. Findings indicated that measures of gunnery speed in training correlated with CAT performance, while measures of accuracy did not. Analyses of Armed Services Vocational Aptitude Battery (ASVAB) data of crewmen selected for CAT failed to support the findings of previous research (Wallace, 1982). Crews commanded by higher mental category (Armed Forces Qualification Test) tank commanders did not perform better than crews commanded by lower mental category commanders. Failure to find this difference was attributed to two potential sources: (a) units attempted to institute a selection policy requiring high composite tank commander/gunner ASVAB scores, and (b) units trained to high levels of performance. (continued) over			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL Barbara A. Black		22b. TELEPHONE (Include Area Code) (502) 624-3450	22c. OFFICE SYMBOL PERI-IK

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SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

ARI Research Report 1442

18. (continued)

Turbulence
Canadian Army Trophy Competition
Personnel selection

Unit Conduct of Fire Trainer (UCOFT)
Crew training
Platoon training

19. (continued)

Results of interviews with company cadre note the advantages of mixing device-based and tank-based training programs. This mixing prevents overlearning simulation (device-based) specific skills and maintains variety in the approach to training. The authors suggest that while CAT offers an excellent opportunity to study advanced gunnery training, some methods may be unique to the CAT environment and not generalizable to the normal TO&E Armor unit training structure.

Keywords: Tanks (combat vehicles), gunnery trainers, army training, maneuvers, personnel selection,

performance (human) ←

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SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

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**Office, Deputy Chief of Staff for Personnel
Department of the Army**

May 1987

FOREWORD

The Fort Knox Field Unit of the Army Research Institute (ARI) is responsible for the conduct of research in the areas of Armor training, simulation, and human performance. This work is sponsored by the Training and Doctrine Command (TRADOC) and the U.S. Army Armor Center and School (USAARMC&S) toward the goal of increasing soldier readiness and improving system performance.

The current review of U.S. Armor crew performance during the Canadian Army Trophy (CAT) competition was initiated as a result of requests from Fort Knox agencies for technical advisory service in the areas of personnel selection, turbulence, and advanced gunnery training. The Office of the Chief of Armor, Personnel Propriety Branch, requested the information. The Weapons Systems Department requested information on the results of previous CAT training strategies, methods for dealing with the stress of CAT, and the use of the Unit Conduct of Fire Trainer (UCOFT) for training CAT gunnery skills. This product has been provided to these agencies, and the results of the analyses have been briefed to individual project officers.

ARI's Fort Knox Field Unit provides research expertise on a variety of Armor-related issues through its ongoing work program and through the channel of technical advisory service. By taking advantage of unique opportunities for training research, such as the Canadian Cup competition, ARI can be better prepared to address soldier performance requirements for the future battlefield.



EDGAR M. JOHNSON
Technical Director

REVIEW OF U.S. ARMOR CREW AND PLATOON TRAINING IN PREPARATION FOR THE 1985 CANADIAN ARMY TROPHY (CAT) COMPETITION

EXECUTIVE SUMMARY

Requirement:

The purpose of this report was to review and evaluate the available data relating performance of U.S. tank crews in the 1985 Canadian Army Trophy (CAT) competition to training and personnel variables. Data were collected from existing company records and from interviews with cadre and crews. Training variables included performance on the Unit Conduct of Fire Trainer (UCOFT) and device mix strategies, while personnel variables included level of turbulence, Armed Services Vocational Aptitude Battery (ASVAB) test scores, and unit assignment policies.

Procedure:

Training data from each U.S. CAT unit were collected from two formal training periods on the UCOFT. Performance measures from the pretests and posttests included target identification time, target hit time, number of hits, and number of rounds of ammunition fired. Platoon leaders were interviewed after the competition for individual crew performance information during CAT. All CAT participants completed a biographical questionnaire after the competition. ASVAB test scores were obtained for all personnel. Correlational analyses were used to examine the relationship between CAT performance and the UCOFT and ASVAB measures.

Findings:

Measures of speed from the second UCOFT training period were positively correlated with CAT performance. The top-scoring U.S. unit received the greatest amount of UCOFT training. No strong relationship was found between ASVAB and CAT performance. However, the average ASVAB scores for the tank commander were higher than the gunner's scores in the two higher scoring U.S. units. This was reversed in the lowest scoring unit with the gunner having higher average ASVAB scores than the tank commander. More personnel changes from initial to final battle roster occurred in the highest scoring U.S. unit. Thus, level of turbulence was greatest in the unit with the best CAT performance.

Utilization of Findings:

The results of this research suggest considerations in training and crew selection procedures for future U.S. CAT competitors. On the training side, over practice appears to be a critical element in performing well under the stressful conditions of the CAT competition. Mixing device-based training with training on the actual equipment prevents learning device-specific responses

and also maintains a high level of motivation. High-fidelity simulators such as the UCOFT are advantageous as part of a CAT training program and a diagnostic tool in personnel selection. The results of examining the level of turbulence suggest that commanders of CAT units should not hesitate when making personnel changes to achieve the best crew combination.

REVIEW OF U.S. ARMOR CREW AND PLATOON TRAINING IN PREPARATION FOR THE
1985 CANADIAN ARMY TROPHY (CAT) COMPETITION

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REVIEW OF U.S. ARMOR CREW AND PLATOON TRAINING IN PREPARATION FOR
THE 1983 CANADIAN ARMY TROPHY (CAT) COMPETITION

INTRODUCTION

The US Army participated in the Canadian Army Trophy (CAT) competition at Bergen Hohne, West Germany, on 10-14 June 1983. Six tank platoons representing the US forces were selected from three units, two platoons each from the 2nd Armored Division (Forward), the 3rd Armored Division, and the 3rd Infantry Division. The CAT competition format assigns units from the six participating nations (Belgium, Canada, Germany, Netherlands, United Kingdom, and United States), to one of two army groups based on their location within the NATO sectors; units are either members of the Central Army Group (CENTAG) or the North Army Group (NORTHAG). Two of the US units were assigned to CENTAG with the third, 2-66 Armor from the 2nd AD (Forward), being assigned to NORTHAG. The competition pits NORTHAG platoons against CENTAG platoons in individual platoon battle runs. The US units consisted of three platoons each for train-up, but only the top two platoons in each unit actually fired at the competition.

The purpose of this report is to review and evaluate the available data relating the performance of US tank crews in the CAT competition to training and personnel variables. The major topics of interest include: a) training on the Unit Conduct of Fire Trainer (UCOFT), and b) personnel selection. The CAT competition is unlike any gunnery exercise currently undertaken by US crews/platoons within their normal gunnery cycle. Thus, CAT offers a unique opportunity to evaluate the training and performance of US Armor units. The opportunity is unique in that tank crews can be stabilized for several months prior to the competition and the international prestige associated with winning results in increased availability of training devices, resources, and training time.

It must be emphasized that the basis for this report was the available data and the subjective opinions of the participants who were interviewed. Every effort was made to work with the units prior to the initiation of CAT specific training to arrange for obtaining UCOFT performance data. Unit cadre were also asked to keep track of their personnel rosters and crew changes over time. This report presents the authors' synthesis of the subjective data and parametric analyses of the UCOFT data provided by the units.

Training in Participating US Units

In a typical TOE Armor unit, training for manual gunnery is constrained by shared resources within the battalion and by time available after priority missions are completed. For the units selected for CAT, priorities are often rearranged so that more time is available for gunnery training. This is done by removing the CAT units from such missions as installation support in which case they would have had to provide gate guards for several days at a time.

The prestige and priority of CAT within the brigade and division have the added benefit of freeing resources such as spare parts, gunnery devices, and access to range or training areas. In addition, the Seventh Army Training Command (7ATC) provides a CAT training liaison team to assist US units in obtaining training ranges, training devices such as the JCOFT, and logistics support to include manufacturer's inspection teams. On the training distraction side, CAT units usually have more visiting dignitaries and interested onlookers than can be found in any similar time period for a normal unit.

The cadre of CAT units have the pressure of trying to achieve the best performance possible in an unfamiliar evaluation environment, along with the stress of international competition. They must develop an approach to training that will keep their crews motivated as they improve their individual and collective skills.

The selected approach differed for each unit in the competition. Some cadre of trainers developed intricate hand eye coordination exercises using snakeboards and the gunner's controls or TC override. In addition, units reported that they asked their personnel to spend time playing any one of several video arcade games that were available to them in the garrison area. This not only served as an outlet for the tension that naturally builds up during the intensive training period, but it was thought to contribute to sustaining individual hand-eye coordination. To train crew and platoon conduct of fire, the units used existing mini-tank ranges as well as unique classroom methods that they developed. For example, some trainers removed the sights from tanks and mounted them on the edges of sand tables. In all cases, conduct of fire was taught by Bergen Hohne lane assignments using training media that were constructed to mirror the four lanes of the CAT competition range. (See Appendix D for Bergen Hohne range map.)

To maintain a level of variety while still concentrating on identified weaknesses, several unit commanders used a rotating training schedule approach. For example, one unit had a five day training schedule:

Day 1 Maintenance	PMCS & Gunner Accuracy Checks
Day 2 Plt/Crew Conduct of Fire.	Mini-tank range and sand table
Day 3 Hand-eye Coordination Exercises .	Snakeboard, VIGS & ATARI
Day 4 Testing	Common tasks and diagnostics
Day 5 Battalion Day	NCO classes

While each unit commander had different training approaches, the focus was the same--continual training. Commanders understood the importance of repetition in sustaining the high level of gunnery skills required for the CAT competition. As a final note, the commander of the highest scoring US unit reported placing emphasis on crew training rather than individual training with the platoon training as a team rather than a collection of individual tanks. This commander firmly believed that the individual was only as good as the crew and the crew only as good as the platoon.

1985 CAT Competition Results

To adequately understand the training for CAT and the effect that training has on a given unit's performance during the competition, one must thoroughly understand the rather unique rules of CAT. The rules governing the 1985 competition can be found in Appendix A. The results of the 1985 CAT are presented in Table 1. The highest scoring unit was 3-64 Armor and the highest scoring platoon was from Panzer Battalion 244. 2-66 Armor finished fourth and 3-32 finished next to last. (See Appendix M for breakdown of CAT results by Army Group and Country.)

Hypotheses

High fidelity training devices, such as the UCOFT, are being used in basic and sustainment training programs. The amount of overall training in Armor units can be greatly increased by using such devices and thereby improve gunnery performance. Thus, UCOFT training by the units involved in CAT suggests the following hypothesis:

Hypothesis 1: There is a positive relationship between UCOFT performance and CAT performance.

ASVAB aptitude area scores, particularly General Technical (GT) and Combat (CO), have been examined as possible predictors of gunnery performance. A positive relationship was found between the tank commander's score on the Armored Forces Qualification Test (AFQT) and performance during the 1983 CAT competition (Wallace, 1982). Therefore, the second and third hypotheses are posed:

Hypothesis 2: There is a positive relationship between tank commander's ASVAB scores and CAT performance.

Hypothesis 3: There is a positive relationship between gunner's ASVAB scores and CAT performance.

Finally, the personnel selection process in the formation of the final CAT rosters allows the opportunity to examine turbulence in the CAT units. Deleterious effects of turbulence have been found in several studies on typical Armor Units. Results of these studies suggest the following hypothesis:

Hypothesis 4: Platoons with less turbulence will perform better in the CAT competition.

Table 1

CAT Scores by Unit

UNIT	NATION	ARMY GRP	TANK	2nd Battle Run		TOTAL
				1st Battle Run		
3-64 AR	US	Centag	M1	21,321	21,934	43,255
Pz Bn 244	Germany	Centag	Leopard II	20,560	22,037	42,597
43 Th Bn	Netherlands	Northag	Leopard II	21,364	19,914	41,278
2-66 AR	US	Northag	M1	20,305	20,341	40,646
4 Pz Bn 24	Germany	Northag	Leopard II	20,011	19,611	39,622
Pz Bn 63	Germany	Centag	Leopard I	19,746	18,957	38,703
2nd Lancers	Belgium	Northag	Leopard I	17,664	18,152	35,816
RSDG	Great Britain	Northag	Chieftain	15,564	17,829	33,393
3-32 AR	US	Centag	M60A3	17,718	14,909	32,627
RCD	Canada	Centag	Leopard I	13,299	15,175	28,474

METHOD

Participants

The participants were tank commanders (TCs) and gunners involved in the train-up for the 1985 Canadian Army Trophy (CAT) competition. The TC/gunner pairs were from platoons in the 2-66 Armor 2nd Armored Division (Forward), 3-32 Armor 3rd Armored Division, and the 3-64 Armor 3rd Infantry Division. These crewmen were selected as potential participants in the CAT competition based on their gunnery performance during both firing densities and Unit Conduct of Fire (UCOFT) training. Selection was also based on mental ability, as measured by the Armed Services Vocational Aptitude Battery (ASVAB), and supervisor judgment of self-discipline and attitude. Soldiers were observed and evaluated throughout the train-up period before final determination of battle rosters. This selection process and the varying numbers of participants involved throughout the train-up caused TC/gunner pairs to change across time.

Two data bases were created and used for the analyses presented in this report. One data base consisted of measures from TC/gunner pairs ($N=14$) that remained intact throughout train-up and the competition. This data base contained measures from the first training period on the UCOFT, the second training period on the UCOFT, and the CAT competition. The other data base consisted of measures from all US TC/Gunner pairs who participated in the actual competition ($N=24$).

Procedure

Each unit's available UCOFT training data were collected from both training periods. The raw data were in the form of computer print-outs for each TC/gunner pair involved in the train-up. The first UCOFT training period consisted of the standard UCOFT exercises. Each exercise contained 6-10 engagements which varied in target range, target movement, type and number of targets, and the movement of the crew's tank. The crewmen were given an orientation phase for familiarization with the UCOFT followed by a pretest consisting of 6-9 exercises. A posttest was given after seven training sessions that was identical to the pretest. Specially prepared exercises were used in the second training period on the UCOFT. These exercises were based on a visual system which replicated the actual CAT competition range. Again, the pretest and posttest were separated by seven training sessions. The training sessions consisted of exercises which also differed in target range, target movement, type and number of targets, and movement of the crew's tank.

After the competition, platoon leaders were interviewed for individual crew performance information. CAT performance for each TC/gunner pair was determined by the platoon leader and platoon member's reenactment on paper of each battle run. The platoon leader's matching of tank crew with engaged target and the hit/miss data resulted in a crew's CAT performance measure (see Appendix C). Copies of the judges' score sheets were obtained for each

platoon's battle run with engagement times and target ranges (see Appendix B). The platoon leader's matching of crew and engaged target was evaluated against the judge's score sheet and the range map (see Appendix D) to determine individual crew engagement times and range to target. Discrepancies, when they occurred, were resolved by assuming the official score sheet was correct in providing range to target and that the platoon leader was correct in determining which crew engaged the target. The discrepancies occurred because officials used a target numbering system which differed from that of the crews'. Therefore, resolution was obtained by measuring specific tank to target ranges and assigning the score for the target that matched the given range.

All CAT participants completed a biographical questionnaire after the competition (see Appendix E). In addition, ASVAB test scores were obtained for all personnel involved in the CAT train-up.

Performance Measures

UCOFT performance measures were extracted from UCOFT print-outs obtained from the units and the UCOFT manufacturer. These measures were used in the analyses on pretests and posttests. They included: (a) average target identification time, (b) average target hit time, (c) number of hits, and (d) number of rounds of ammunition fired. Percent hits, as a measure of accuracy, and the difference between target hit time and target identification time, as a measure of speed, were calculated and used in the analyses.

The CAT performance measures were: (a) average opening time, (b) number of hits, (c) number of rounds fired, and (d) average range of targets. Percent hits was computed as a measure of accuracy. ASVAB aptitude area scores used in the analyses were: (a) General Technical (GT), (b) Combat (CQ), (c) Skilled Technical (ST), and (d) the Armed Forces Qualification Test (AFQT).

RESULTS

Training Data - Unit Conduct of Fire Trainer (UCOFT)

CAT personnel were involved in two formal training periods on the UCOFT. The data base in this analysis was composed of measures from TC/gunner pairs who remained intact from the first training period on the UCOFT through the CAT competition (N=14). For the available data, performance improvement occurred for all variables from pretest to posttest after seven training sessions on the UCOFT. Performance improvement on the UCOFT occurred for all three units involved in the competition and for both training periods (see Appendix F).

Only a few significant correlations were found between the UCOFT variables and the CAT performance variables (see Appendix G). Measures of speed from the second training period were positively related to speed in the competition. However, accuracy measures on the pretests and posttests from both training periods on the UCOFT were not related to accuracy measures in the competition.

Unit differences between overall posttest performance were examined by calculating the crew's average posttest performance on each measure for both UCOFT training periods (see Table 2). Unit 3-64 performed significantly better on target identification time ($F(1,11) = 7.36$; $p < .05$), target hit time ($F(1,11) = 20.78$; $p < .01$), and the difference between target hit time and target identification time ($F(1,11) = 24.24$; $p < .01$). Unit 3-32 had significantly degraded target identification time ($F(1,11) = 5.31$; $p < .05$) and significantly lower number of hits ($F(1,11) = 21.50$; $p < .01$) than the other two units (see Table 2). Each unit was ranked on speed and accuracy from the UCOFT posttests and the competition results. The comparison of these rankings indicated that Unit 3-64 was faster in engaging targets in both the UCOFT train-up and the competition than was Unit 2-66. The rankings for accuracy indicated that although Unit 2-66 was slightly more accurate on the UCOFT, Unit 3-64 was more accurate in the actual competition. (See Table 3 for results of CAT performance.) Therefore, the only meaningful difference between the units on UCOFT posttests when compared to their CAT performance was in the speed of engagement.

Each crew's performance improvement on the UCOFT was computed by finding the difference between crew pretest and posttest performance on each measure. The differences between pretest and posttest on each measure for the two training periods were averaged. These averages represented the crew's overall performance improvement for both training periods. As Table 4 indicates, Unit 3-64 improved the most on all measures except target identification time. Their fast identification times on pretest precluded any large performance increments. However, Unit 3-64 did improve significantly in the time from target identification to target hit time ($F(1,11) = 7.01$; $p < .05$). The most dramatic unit difference was in accuracy. Unit 3-64 significantly improved their overall percentage of hits compared to the other two units ($F(1,11) = 7.68$; $p < .05$). This result was comparable to their top ranking on accuracy in the CAT competition (see Table 3).

Table 2

Mean Posttest Performance Measures over Both UCOFT Training Periods by Unit for Crews with TC/Gunner Pairs that Remained Intact

	Unit 2-66	Unit 3-32	Unit 3-64
Target Identification Time			
<u>M</u>	1.71	2.07	0.93
<u>SD</u>	0.62	0.49	0.28
<u>n</u>	7	4	3
Target Hit Time			
<u>M</u>	10.68	10.05	6.39
<u>SD</u>	1.34	1.12	1.56
<u>n</u>	7	4	3
Target Hit Time Minus Target ID Time			
<u>M</u>	9.02	7.93	5.46
<u>SD</u>	0.89	0.56	1.39
<u>n</u>	7	4	3
Main Gun Hits			
<u>M</u>	7.54	6.48	7.13
<u>SD</u>	0.30	0.29	0.33
<u>n</u>	7	4	3
Percent: Hits per Rounds Fired			
<u>M</u>	85.42	80.99	84.50
<u>SD</u>	2.84	3.33	6.06
<u>n</u>	7	4	3

Note: The M values represent the means of the posttest scores for both training periods.

Table 3

CAT Performance Measures by Unit for Crews with TC/Gunner Pairs that Remained Intact

	Unit 2-66	Unit 3-32	Unit 3-64
Average Opening Time (seconds)			
M	9.16	10.75	7.07
SD	4.00	2.89	1.03
n	7	4	3
Number of Hits			
M	8.14	7.25	8.67
SD	2.12	0.96	0.58
n	7	4	3
Number of Rounds Fired			
M	9.86	10.00	9.00
SD	0.38	0.82	1.00
n	7	4	3
Percent: Hits per Rounds Fired			
M	82.29	72.75	96.67
SD	19.75	8.99	5.77
n	7	4	3
Average Range of Targets (meters)			
M	1532.71	1549.50	1445.33
SD	65.31	31.78	77.85
n	7	4	3

Table 4

Overall Performance Improvement for Both UGOF Training Periods by Units for Crews with TC/Gunner Pairs that Remained Intact

	Unit 2-66	Unit 3-32	Unit 3-64
Target Identification Time ^a			
\bar{M}	-1.48	-1.43	-1.02
SD	1.22	1.07	0.35
n	7	4	3
Target Hit Time ^a			
\bar{M}	-2.22	-1.33	-3.22
SD	1.86	0.88	1.21
n	7	4	3
Target Hit Time Minus Target ID Time ^a			
\bar{M}	-0.70	0.05	-2.20
SD	1.18	0.71	1.19
n	7	4	3
Main Gun Hits ^b			
\bar{M}	0.75	0.83	1.38
SD	0.65	0.34	1.44
n	7	4	3
Percent: Hits per Rounds Fired ^b			
\bar{M}	2.86	7.51	19.17
SD	7.35	1.79	12.55
n	7	4	3

Note: The \bar{M} values represent the means of the difference scores between pretest and posttest for both training periods.

^aFor these variables, greater improvement was indicated by smaller values.
^bFor these variables, greater improvement was indicated by larger values.

Armed Services Vocational Aptitude Battery (ASVAB) and CAT Performance

Test scores on the ASVAB and the AFQT were collected for all crewmen involved in the CAT train-up. The data base used in this analysis was composed of measures from all TC/gunner pairs involved in the actual competition (N=24). Relationships were examined between CAT performance, the AFQT, and three aptitude areas of the ASVAB: General Technical (GT), Combat (CO), and Skilled Technical (ST). Only a few correlations between the TC and gunner test scores and CAT performance were significant (see Appendix H). The TC's ST score was negatively related to accuracy measures and the measure of speed. Therefore, the higher the ST score for the tank commander, the lower the accuracy and yet the faster the time to first engage. However, the gunner's GT, CO, and AFQT test scores were positively related to engagement times, suggesting the higher the test scores, the longer the engagement times.

The negative correlations between the TC's ASVAB and the measures of accuracy and speed may have resulted from the priority of speed in the competition's scoring system. The faster an engagement with a hit, the greater the points awarded. Although bonus points were given for returning ammunition after the battle run, the points were fewer than those given for second- or third-round-hits where the reengagement times were fast. Also, the bonus was only given if all targets had been hit within the time limit. Each platoon had 40 rounds of ammunition to engage 24 targets, more than enough ammunition to ensure hits on all targets. TCs understood that hitting all targets in the least amount of time was the priority whether it took one round or three rounds. Rather than trading off speed for first-round-hits, TCs may have chanced a miss on initial engagements to earn more points.

Correlations between the TC and gunner ASVAB scores and AFQT were computed. Three out of the four negative correlations were significant (see Table H.2). The negative correlations suggested that the higher the TC scores, the lower the gunner scores and vice versa. Average scores from the raw data on the ASVAB subtests and the AFQT were examined on the initial crew/platoon roster and the final roster for each unit. For Units 2-66 and 3-64, TCs had higher average test scores than gunners on the final roster. Unit 3-32 had higher average test scores for gunners than TCs on the final roster. Unit 2-66 and Unit 3-64 raised the average TC test scores from the initial to final roster with personnel changes while maintaining the gunner test scores. On the other hand, Unit 3-32 raised the average gunner test scores with different personnel while lowering or maintaining the TC scores. Unit 3-32 had the lowest average TC scores on the final roster and the highest average gunner scores of all three units. Unit 2-66 and Unit 3-64 were opposite, with the highest average TC scores and lowest average gunner test scores on the final roster. (See Appendix I for details of the changes in test scores from initial to final roster.) An interesting point emerged when examining the average ASVAB scores of TC/Gunner pairs on the final battle run roster. The two units who received more points in the competition had TCs with higher average scores. These TCs were paired with gunners who had lower average scores. In contrast, the unit with the lowest points in the competition paired TCs who had lower average scores with gunners who had higher average scores.

Biographical Data and CAT Performance

Biographical data were collected from all US personnel involved in the CAT competition. The relationship between the TC and gunner biographical data and the CAT performance was examined through correlational analysis (see Appendix J). The only significant correlation for TCs was between the time in duty position with the crew and the accuracy measure. The positive direction of the relationship indicated that as the time in crew as a TC increased, accuracy increased. The gunner's time in pay grade was positively correlated with accuracy indicating that the longer the time in pay grade, the greater the accuracy. A positive relationship also existed between the gunner's time in platoon and engagement time. The positive direction suggests the longer the time in platoon, the longer the time to engage a target, a finding that is difficult to explain. (See Appendix K for summary measures on biographical data and CAT performance.)

Turbulence and CAT Performance

Turbulence has been reported as a source of crew performance deficiencies (Eaton, 1978; Larson, Earl & Henson, 1976). The initial and final CAT rosters were examined for personnel changes in duty position and crew from the beginning of train-up to the actual competition. Turbulence was examined in two ways. Duty position stabilization was calculated by the percentage of personnel remaining in the same position throughout the train-up. Crew stabilization was the percentage of personnel remaining in the same crew. Turbulence was calculated for the individual units to investigate differences in turbulence when compared to rankings in the competition (see Table 5).

Duty position stabilization was very high in all three units. There was no switching of TC and gunner duty positions in any unit. Only Unit 3-64 switched personnel in the driver and loader positions. Overall crew turbulence was the most dramatic and mysterious. Unit 3-64 had the lowest crew stabilization for TCs and gunners (75%, four out of 16 positions with personnel changes). This occurred in only one platoon. The other platoon had no changes for TCs and gunners. Ironically, the platoon with greatest turbulence performed the best in the CAT competition. Units 2-66 and 3-32 had 88% and 94%, respectively, overall crew stabilization for TCs and gunners. Again, turbulence occurred in only one platoon per unit. When considering the driver and loader positions, crew stabilization dropped even lower for Unit 3-64 (59% stabilization) with 13 out of 32 personnel being replaced from the initial roster to the final roster. When considering drivers and loaders in the other two units, crew stabilization was 88% for Unit 2-66 and 97% for Unit 3-32. Unit 3-32 had the best overall crew stabilization with least turbulence and yet obtained the lowest scoring performance in the CAT competition of all three units. On the other hand, Unit 3-64 had the most turbulence and scored the highest in the competition.

Table 5

Stabilization of Crews Within Units from the Initial to Final Rosters in the CAT Competition

	Unit 2-66	Unit 3-32	Unit 3-64
Percentage of TCs remaining in same crew	88	100	75
Percentage of Gunners remaining in same crew	88	88	75
Percentage of Loaders remaining in same crew	88	100	63
Percentage of Drivers remaining in same crew	88	100	25
Percentage of Overall crew stability	88	97	59
Percentage of Personnel remaining in TC position	100	100	100
Percentage of Personnel remaining in Gunner position	100	100	100
Percentage of Personnel remaining in Loader position	100	100	88
Percentage of Personnel remaining in Driver position	100	100	88

DISCUSSION

The purpose of this report was to review and evaluate the available data relating performance of tank crews in the 1985 Canadian Army Trophy competition to training and personnel variables. Data were collected from existing unit records and from interviews with cadre and crews. Training variables included UCOFT performance and device mix strategies, while personnel variables included level of turbulence, ASVAB aptitude area scores, and unit assignment policies.

With regard to the UCOFT training data, it appears that use of the UCOFT may have been a factor contributing to high performance. The highest performing CAT unit made two one-week trips to the UCOFT facility in Florida and received the first UCOFT fielded in Europe. Thus, they had the most time to train on UCOFT. The second highest performing CAT unit trained on M1 UCOFTs for one week in Florida and one week at Vilseck, Germany. The third finisher, an M60A3 unit, had two trips to Florida, lasting one week each, to train on production M60A3 UCOFTs. The UCOFT served as a major resource and was used to both select and train tank crews. In general, its major value was in increasing engagement speed by reducing the time the gunner used to make a fine lay on the target. It should be noted that the UCOFT visual system was modified to reflect the actual CAT competition range and this system was used for each unit's second training trip. While measures of engagement speed on UCOFT for this training period were correlated with engagement speed for the actual competition, it is impossible to determine the effect of UCOFT training apart from the issue of range familiarity. This is highlighted by the fact that performance on exercises within the normal UCOFT training matrix (i.e., where generic ranges are used) did not correlate with performance in CAT.

Comments from the unit commanders indicated their high regard for UCOFT as a procedures trainer and also its usefulness as an evaluation tool for selecting crewmen. However, they concluded that it was important to consistently mix device-based and on-tank training in order not to over train tasks that might be specific to the device and not related to actual equipment performance.

In the area of personnel criteria, findings did not support previous research (Wallace, 1982) which noted that personnel variables such as tank commander mental category were predictive of CAT tank crew battle run performance. Interviews revealed that because West Point research (Scribner, Smith, Baldwin & Phillips, 1984) indicated a relationship between TC AFQT and battle run performance, some units attempted to implement a crew selection policy whereby TC/gunner pairs would have a combined minimum GT score of 200. A review of the available ASVAB data from crews participating in the CAT showed that the units were only moderately successful at implementing this policy. Of the 15 crews for which ASVAB data were available, only 10 of the TC/gunner pairs had a combined GT over 200. In addition, there was no significant correlation between TC/gunner GT and CAT performance.

Interviews with unit cadre revealed the rather pervasive view that smarter tank commanders are better leaders. This may not always apply, however. In reviewing the ASVAB data from the three units and comparing rosters from the competition, it was noted that in the two high scoring US units, the tank commanders had higher average GT scores than their gunners. This was not the case for the lower scoring unit. What may have taken place was that under the extreme pressure of the competition, any disagreement or conflict between tank commanders and their gunners as to the appropriate action was magnified. The lower scoring unit reported that their platoons "fell apart" during the battle run. The platoon fire distribution plan was not followed and crews began firing "at will." This could be due to a lack of confidence in the crew's or platoon's ability to execute their plan. Contributing factors could include lack of sufficient practice and lack of confidence in the actions of other members of the crew or platoon. While higher mental category TCs may in fact engender greater confidence from their subordinates, intelligence cannot compensate for all training deficiencies.

Findings indicated that other personnel variables may play a role in performance. The unit with the highest turbulence also had the highest CAT battle run scores. This is in contrast to the usual situation in which it is important to minimize turbulence and thereby reduce its deleterious effects. It may be that when crewmen, as individuals, are fully trained for a given tank crew position and mission, collective performance can only be improved by replacing one of the existing crewmen with a new crewman having greater individual skills. In contrast, when individual performance is average or below, it is important to stabilize the crew members in order to avoid performance decrements associated with idiosyncratic behaviors of the new crew-member. If a crewman is highly skilled, translated, proficient, and standardized, in his performance in a given crew position and is placed in a crew of highly skilled, standardized crewmen, then it will not take long for the crew to "jell." Hence, the importance of standardization in training exists, especially for situations such as war where turbulence is likely to be unpreventable.

In the case of the CAT crews in the highest scoring unit, the skill levels were already extremely high as was the standardization. Therefore, the only way to improve the overall crew performance, (e.g., to shave another 0.5 seconds off the engagement time), may have been to locate and insert an even higher skilled crewmember. In other words, all these crewmen had probably reached their maximum individual performance level. This may be the reason for the higher turbulence rate in the best performing unit, even though this seems contrary to the results of numerous studies describing the deleterious effects of turbulence. The turbulence issue is an example of why it is important not to generalize too quickly from events or findings in the CAT competition or try to apply them to regular TO&E unit situations without careful consideration for the differences in mission and time available for training. To do otherwise, one might infer that turbulence is beneficial and could improve gunnery performance.

What is immediately apparent when working with CAT units is the intense concentration and dedication required to train for such a long period of time and so intensely for one chance at a set of 24 targets. What is also apparent

is the fact that to have a chance to win the competition means modifying the majority of Armor doctrine as far as crew conduct of fire procedures are concerned. For example, to perform well in the CAT competition, units must extremely abbreviate fire commands. This is necessary in order to minimize engagement times and thereby maximize the platoon battle run score. Units must also obtain as much range specific practice as possible above the number of live firings allowed. This can be accomplished in numerous ways. Some units dry-fired Bergen Hohne behind other platoons who were shooting their scheduled live-fire training exercises. To supplement actual exposure to the competition range, all units tailor-made sand tables to match the Bergen Hohne range. Some units videotaped both their live-fire and dry-fire exercises and used the videotapes to practice platoon fire commands and target hand-offs.

The chief complaint concerning CAT is its uniqueness, the fact that it does not resemble in format or requirement those tasks that are described in US gunnery manuals (e.g., FM 17-12-1). Questions are often raised as to the value of this competition specific training in terms of the development of overall gunnery skills. In a partial attempt to determine if the skills acquired for CAT transfer or generalize to those requirements for tank Table VIII, the three participating units were required to travel to Grafenwoehr, Germany, to fire Table VIII immediately following the competition. The Table VIII was scored in the normal fashion, which emphasized doctrinal based standardization of fire commands, i.e., "crew cuts", etc. Not too surprisingly, the unit that had the most difficult time scoring points at the CAT competition, did better on the traditional Table VIII than did the other two CAT units.

All of this information would lead one to believe that few of the CAT lessons learned on tank gunnery training would or could generalize to normal TO&E units, but this deserves a second look. CAT is an excellent opportunity to determine how proficient a given Armor platoon can become, in one year, if released from all responsibilities except those directly related to gunnery training. It also allows the opportunity to observe the creativity exhibited by unit trainers as they try different ways to teach and reteach gunnery tasks while attempting to keep crews goal-oriented and motivated.

In summary, review and evaluation of the 1985 CAT competition suggest the following considerations for future CAT competitors. Training devices should be alternated or mixed with training on the actual equipment. This prevents device-specific responses and provides needed variety from a motivational standpoint. Units should not resist shifting personnel within crews and platoons to achieve the best possible combination. Over practice pays high dividends when tasks must be performed under stress. Units that are well supported by battalion and brigade perform better in CAT, either because more training time is available or more resources or both. High fidelity training devices such as the UCOFT can be beneficial in initially selecting personnel for participation in CAT and in training for CAT.

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APPENDIX A
1985 CANADIAN ARMY TROPHY COMPETITION RULES AND CONDITIONS

Rules¹

To fully appreciate the specialized training units undergo in preparing for CAT, an understanding of the CAT rules is required. All CAT rules are structured to support the two goals of the competition:

1. To improve the overall standard of tank gunnery within participating forces; and
2. To enable participating teams to meet in a spirit of true comradeship and fraternity (Walters, 1985).

The rules have undergone major revisions in recent years moving the competition from single tanks firing from fixed points at known ranges to the current requirements which test four-tank platoons over "battle runs" consisting of firing (both stationary and on the move) at both static and moving targets.

The NORTHAG and CENTAG teams consist of 10 platoons. The winning Army Group is determined by the aggregate battle run scores from the 10 platoons. The participating forces must have selected their representative tank units no later than three months prior to the competition. Selected units must come from regularly formed (organic) corps and not from specially formed units. In addition, alteration of national personnel assignment policies is prohibited. Team lists containing tank crewmembers by name, rank, and position must be presented to the CAT Chief Judge at least two weeks prior to the competition. Only nominated reserves of the same rank and position can be substituted in the event a crewmember is prohibited from competing.

Rules covering pre-competition training include the following:

1. Main gun range time provided to competing tank units will be limited to the normal national yearly allocation.
2. Total main gun expenditure for competing tank units will not exceed 134 rounds per crew from 1 October 1984 through June 1985.
3. No live main gun ammunition is to be fired after 7 June 1985.
4. Range 9, Bergen Hohne, the competition range, will be made available to the teams (on 1 and 2 June 1985) for safety orientation.

¹NOTE: The Rules section is based on information provided by Major David Walters, Executive Officer 3-64 Armor (See Walters, 1985).

5. Range 9 will be out of bounds to all competing teams and those concerned with training the teams from 3 June 1985 to the start of the competition.

6. Regarding the equipment used for CAT, the tanks must conform to normal national standards and no special equipment is to be fitted for the competition. In addition, tank units must use their own (organic) tanks.

The competition will take the form of a fire and movement exercise over three bounds by platoons of four tanks. Each platoon exercise is called a Battle Run. Each tank is to stow 10 practice rounds (DS/T, TPDS, MZ, KE, or "Lochkegel-leitwerk") for the main gun and a total of 250 rounds of machine gun ammunition. The combination of tracer and ball ammunition loaded may not be more than one tracer round for every three ball rounds (i.e., no more than 62 tracer rounds out of the 250 rounds of machine gun ammunition). In addition, each tank is to carry a reserve of four main gun rounds and 125 rounds of machine gun ammunition that may be used only with the judges' authority.

All targets will be of the same size and shape. The targets will measure 190cm in width and 160cm in height, and will be painted a dark color. An example is illustrated in Figure A-1.

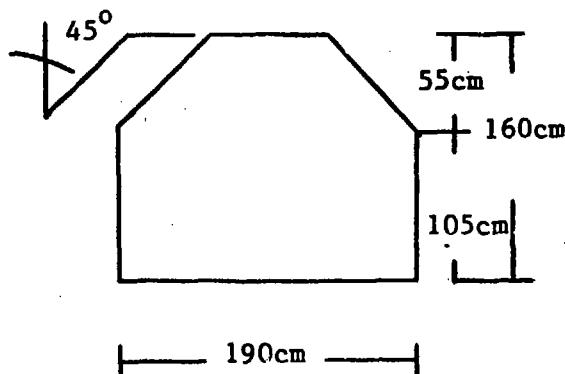


Figure A-1. Size and shape of all main gun targets both moving and static.

The total number of targets for each Battle Run will be:

1. Main Gun. Twenty-four (24) targets will be presented and distributed among the three bounds. These may be static or moving. The movers may be head-on, oblique, or flank. Targets engaged from a static firing position and on the move will normally be below 2000 and 1200 meters respectively. The distance may be increased, if possible.

2. Machine Gun. There will be eight groups of ten falling plate targets. Each group will be dispersed to depict deployed dismounted troops, and will be at a range less than 1000 meters. They are to be engaged while the platoon is on the move between bounds. The falling plates engaged on the move from bounds one to two will not be engaged again during the move from bound two to three.

All targets may be engaged by one or more tanks within the platoon. Each main gun engagement will comprise from two to six targets at various ranges. Main gun targets need not be visible to each tank within a platoon, except on the last bound where all main gun targets are to be visible to each tank. Two targets will be presented for engagements on the move between each bound. One of the four will be a moving target. Multiple targets of one engagement will appear within ten seconds. In the interests of fairness and of affording equal opportunity to all platoons, all firing points on each bound will be watered before a battle run begins to reduce and equalize obscuration.

There will be a minimum of ten different target layouts and one spare layout for reruns. Each layout must comprise at a minimum:

1. Five main gun engagements distributed between three bounds.

- a. Two engagements with both static and moving targets.
- b. One additional engagement with moving targets.
- c. One engagement with six targets.

2. Two main gun engagements for each move between bounds, with both moving and static targets.

All targets to be engaged will be indicated by a single puff of smoke in front of the phase line. The puff will be fixed within five (5) seconds of the complete target presentation being fully upright. This means, for example that there will be only one puff for as many as six targets. Machine gun (MG) targets will not be indicated. If during an engagement, additional puffs are accidentally initiated, they are to be disregarded.

Team Captains are responsible for determining the sequence in which their units will compete, as well as the firing sequence of the platoons in each unit. The Team Captains must inform the Chief Judge of the firing order for their Teams by 7 June 1985. The firing order for Army Group Teams should be such that the next platoon belongs to a different nation.

After control has been established in the waiting area, a competition judge is to give the command "MOVE TO BOUND ONE" by radio. All commands to the firing platoon during a battle run are to be given by a competition judge in the national language of the competing platoon. Once the order to move

has been acknowledged by the competing platoon, the movement from the waiting area to the competition range must be completed within the time prescribed by the Chief Judge. After the lapse of the prescribed time, penalty points will be assessed for late arrival at bound one. For safety reasons, the move to bound one from the waiting area is to be carried out with weapons clear. After arrival at bound one, weapons are to be loaded on the command "CARRY OUT ACTION." A maximum of two minutes will be allowed to load weapons. When the platoon reports "READY," or when the two minutes has expired, the command "WATCH YOUR FRONT" will be given by a competition judge.

Main gun targets will be exposed for 40 seconds. This time will begin when each individual target is upright. No targets will be presented until at least 30 seconds have elapsed after the command "WATCH YOUR FRONT." At any time thereafter, targets may be presented without further warning. If more than one engagement is fired from a bound, a minimum of 15 seconds will elapse between engagements. There is no restriction on the number of rounds that may be fired at any target. All targets for an engagement will be lowered at the same time. When no more targets are to be presented from a bound, the order "YOUR FRONT IS CLEAR" will be given, allowing tanks to move to the next bound.

Two main gun targets and MG falling plate targets will be presented between each of the bounds. All targets must be engaged on the move. This includes target acquisition, laying, ranging and firing. If a tank halts for any reason between bounds and subsequently fires during the bound, a zero score will be given to the entire platoon for that particular bound. If a machine gun target is engaged with the main gun, no points for that MG falling plate area will be given. If MG falling plates for bound one to two are engaged during the move from bound two to three, there will be no score allocated to the MG falling plate area engaged.

A specific period of time will be given for each move between bounds. The time will represent an average speed of 10 mph and will be established by the Chief Judge prior to the start of the competition. Time will start when the Chief Judge orders the platoon to begin movement and will end when the last tank stops. Tanks must move on line. When in the opinion of the Chief Judge all tanks are firm on a bound, he will give the command "WATCH YOUR FRONT". Targets to be engaged from the bound may be presented without further commands after a minimum of 30 seconds has elapsed. This sequence is continued up to and including bound three. It will be seen from the foregoing that the platoon at the outset knows only the total number of targets to be engaged on the move. Any number of targets to be engaged from a bound within the total may be presented at each bound.

After completion of the final engagement on bound three, the Chief Judge will announce "YOUR FRONT IS CLEAR, THIS CONCLUDES YOUR BATTLE RUN." At the end of each battle run, the platoon of tanks clears weapons. The Safety

Officers personally check all weapons and ammunition. Thereafter, the Control Team checks the ammunition consumption. The tanks remain at bound three until instructed by the Chief Judge to return to their units by the designated route. Empty cases may be jettisoned at any time during a battle run. These will be recovered by a detail provided by the Chief Judge. The spent casings will be delivered to the competing platoon upon completion of the battle run.

In principle, misfires are considered warlike hazards that, subject to the maintenance of safety, should not in any way influence the continuation of the battle run. Engagements in which misfires occur will not be fired again. A misfire will be considered expended ammunition and will not count toward ammunition bonus points as unexpended ammunition. No extra time will be given for mechanical failures. Should any failure occur, the tank commander is to immediately inform Control and put up a yellow flag. The battle run will continue regardless of failures. This rule applies from the moment the platoon is called forward from the waiting area until the end of the battle run. When the fault has been rectified, the tank commander in question will obtain permission from Control before rejoining the battle run.

Judging-Scoring

The competition is to be judged by the Chief Judge and a panel of judges. The Chief Judge will be provided by the Host Army Group. Each nation (BE, CA, GE, NL, UK and US) is to provide two judges. They may be neither members of the Committee of Control, nor members of a competing team. The organization, deployment, and rehearsal of the judging staff, safety officers, and control teams is the responsibility of the Chief Judge.

For the conduct of the battle runs, the Chief Judge's decision is final. The Chief Judge will designate timekeepers who will be equipped with stop watches. These timekeepers will be provided by the participating nations as required by the Chief Judge. The judges will produce a Score Sheet for each battle run. They will fill in their score sheets as the battle run progresses, and apply appropriate scoring procedures. After each battle run, the judges will confer and go down the range to confirm the hits on all main gun targets. Judges' Score Sheets will be handed over by the Chief Judge to the Committee of Control after each battle run. (Copies of the Judges' Score Sheets for the six US platoons are in Appendix B.)

The basic principle of the scoring system is the achievement of a successful engagement of a target, irrespective of the number of hits, within the time limit. A successful engagement is defined as one in which there is at least one hit on a target within the time limit laid down. This does not include splinters or ricochets. In cases of doubt, the Chief Judge has absolute discretion. The time limit is the period of 40 seconds for the main gun targets, measured beginning at the time targets are fully upright. Any shot fired outside the time limit will be ignored in the scoring of the battle run

(See Table A.1 for point allocations). Bonuses will be given for main gun ammunition remaining after completion of the battle run, providing all main gun targets have been hit within the time limit. A bonus will also be awarded for hitting all main gun targets (See Table A.2 for point scale). For machine gun, only those targets that fall down will be scored in each of the eight MG target groups. Table A.3 outlines the allocation of points that would result in a maximum platoon battle run score of 28,100 points.

Table A.1

Allocation of Points for CAT Competition

Main Gun:

Hit Score: A successful engagement: 500 points

Time Score: A sliding scale of 500 points for one second decreasing to 0 points at 40 seconds.

Ammunition Bonus: Per round remaining at the end of the battle run providing all main gun targets are successfully engaged 100 points

Hit Bonus: For hitting all 24 main gun targets. 500 points

Machi- gun:

Hit Score: For each target that falls: 25 points
If ... targets are engaged with the main gun no points for this MG target group will be given.

Penalties:

For not arriving at a bound in the specified time 600 points

For use of reserve ammunition without authorization, per round 1000 points

Table A.2

Allocation of Points by Time of Hit

Hit in Seconds	Points	Hit in Seconds	Points
1	1000	21	652
2	988	22	644
3	975	23	636
4	963	24	628
5	950	25	620
6	925	26	612
7	900	27	604
8	875	28	596
9	850	29	588
10	825	30	580
11	800	31	572
12	775	32	564
13	750	33	556
14	725	34	548
15	700	35	540
16	692	36	532
17	684	37	524
18	676	38	516
19	668	39	508
20	660	40	500

NOTE: Any portion of a second registered on a stop watch will be counted as the next full second in determining the fire time. For example, 6 1/10 seconds will be counted as 7 seconds.

Table A.3

Maximum Possible Point Allocation for Platoon Battle Run

Hit Score (24 targets x 500 points)	12,000 points
Time Score (24 targets x 500 points)	12,000 points
Hit Bonus (500 points)	500 points
Ammunition Bonus (16 rounds x 100 points)	1,600 points
MG Score (80 plates x 25 points)	<u>2,000 points</u>
Total per Platoon	28,100 points

The end of the competition will be declared on the last day, even though all platoons may not have had the opportunity to fire. If, due to an excessive loss of firing time, all platoons have not completed their battle runs, the final team score will consist of the scores earned by the maximum equal number of platoons per Army Group Team. A minimum of one battle run per team member must have been fired to constitute a competition. After each battle run the scores are to be verified by the Committee of Control and then posted on the master scoreboard. In case of a tie, the greater number of successful engagements will decide the winning team. If the number of successful engagements are the same, the team that had the greater number of time points shall be declared the winner.

**APPENDIX B
JUDGES' SCORE SHEETS FOR
ALL SIX US PLATOONS IN THE CAT COMPETITION**

CAGE SYSTEM - CANADIAN ARMY TROPHY 1968 - (C) 1968 GROUP LEADER

8 PLATOON ID-CODE : NTU 2/66/2
 8 PLATOON COMMANDER : 101210-JUNES
 8 DTG : -
 8 SECTOR : -
 8 METEO : CLEAR/OVERCAST
 8 RUN/DAY : 3

ROUND	RED	SHOTS	TARGET	NAME	1	2	3	4	5	SCORE
1	1	8	T1 1.	1800	14 0					720
			T2 .	1900	29 0					280
			T3 .	1200	63 0	12 0				720
			T4 .	1300	62 0					700
			T5 .	1600	15 0	21 0				700
			T6 .	1450	64 0					0
MOVE	2	3	T7 .	1200	64 0					743
			T8 .	1250	63 0					773
			T9 .	1800	20 0	24 0				640
			T10 .	1600	64 0					743
2	3	4	T11 .	1850	64 0					743
			T12 .	7	64 0	12 0	42 0			728
			T13 .	7	22 0					644
			T14 .	7	18 0					676
			T15 .	7	15 0	21 0				700
MOVE	5	3	T16 .	1500	67 0	11 0				700
			T17 .	1300	63 0					0
3	6	4	T18 .	1700	62 0	17 0	21 0			700
			T19 .	1100	69 0					650
			T20 .	1300	16 0					672
			T21 .	1450	26 0	27 0				664
			T22 .	1700	63 0					773
7	7	7	T23 .	1400	64 0	33 0				743
			T24 .	1200	62 0					700

TOTAL SCORE MAIN ARMAMENT

19465

REMARKS:

MG SCORE PER GROUP : A : 250
 B : 200
 C : 250
 D : 200
 E : 250
 F : 250
 G : 250
 H : 250

TOTAL SCORE MG : 2500

AMMUNITION BONUS : 0

HIT BONUS : 0

TOTAL PENALTIES : 0

TOTAL SCORE : 20305

1st Battle Run
 Unit 2-66

GLOBAL RUN ANALYSIS

PLATOON ID-CODE : NTUC2/66/C
PLATOON COMMANDER :
BTG : 101215JUN85
SECTOR :
METEO : CLEAR/OVERCAST
RUN/DAY : 3

MAIN GUN : 1.ON BOUND : AVERAGE TIME FIRST SHOT : 10.7 S
AVERAGE TIME FIRST HIT : 13.31 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 75 %

2.MOVING : AVERAGE TIME FIRST SHOT : 4.25 S
AVERAGE TIME FIRST HIT : 4.44 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 75 %

3.TK-TARGETS NOT HIT : ENGAGEMENTS PLUS : 50 %
: ENGAGEMENTS MINUS : 0 %

4.FIXED TARGET HITS : 99.47 %

5.MOVER HITS : 100 %

6.TARGETS NOT ENGAGED : 0 %

RS : HITS : 75 %

Continued

DAKE SYSTEM - CANADIAN ARMY TROPHY 1988 - CCF 1988 GROUP LEOPARD

0 PLATOON ID-CODE : NTUS/244/3
0 PLATOON COMMANDER :
0 DTB : 14101200000
0 DIRECTOR : -
0 METED : BLINDY/CLEAR
0 PLAN/DAY : 1.3

ROUND	SEG	SHOTS	TARGET	RANGE	1	2	3	4	5	SCORE
1	1	7	T1 .	1000	11 R	21 R				330
			T2 .	1000	03 R					270
			T3 .	1000	06 L	23 R				420
			T4 .	1000	02 R					380
			T5 .	1000	37 R					0
	2	3	T6 1.	1000	04 R	11 R				362
			T7 1.	1000	03 R					270
MOVE	3	3	T8 1.	1000	02 R	17 R				380
			T9 .	1000	03 R	05 R	13 R			550
2	4	10	T10 1.	1000	26 -					0
			T11 .	1000	07 R	29 R				390
			T12 .	1000	12 R					270
			T13 .	1000	04 R	23 R				362
			T14 .	1000	08 R	17 R				380
			T15 .	1000	10 R	34 R				550
	5	1	T16 1.	1000	32 R					364
MOVE	6	4	T16 .	1000	05 R	07 R				360
			T17 .	1000	04 R	09 R				550
3	7	5	T18 .	1000	17 R					380
			T19 .	1000	11 R	29 R				390
			T20 .	1000	28 R					270
			T21 .	1000	01 R					1000
	8	3	T22 .	1000	03 +	18 R				370
			T23 .	1000	10 R					550
			T24 .	1000	03 -	28 R				0
TOTAL SCORE MAIN AMOUNT										18341

REMARKS:

HS SCORE PER GROUP : A : 250
 B : 250
 C : 250
 D : 250
 E : 250
 F : 250
 G : 250
 H : 250

TOTAL SCORE HS : 2000

AMMUNITION BONUS : 0

HIT BONUS : 0

TOTAL PENALTIES : 0

TOTAL SCORE : 20341

2d Battle Run
Unit 2-66

GLOBAL RUN ANALYSIS

1 PLATOON ID-CODE : NTUS/266/3
1 PLATOON COMMANDER :
1 DTG : 141015JUN85
1 SECTOR : 9
1 METEO : SUNNY/CLEAR
1 RUN/DAY : 3

MAIN GUN : 1.ON BOUND : AVERAGE TIME FIRST SHOT : 11.17 S
AVERAGE TIME FIRST HIT : 11.64 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 85.71 %
2.MOVING : AVERAGE TIME FIRST SHOT : 3.5 S
AVERAGE TIME FIRST HIT : 5.75 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 100 %
3.TK-TARGETS NOT HIT : ENGAGEMENTS PLUS : 9.09 %
: ENGAGEMENTS MINUS : 9.09 %
4.FIXED TARGET HITS : 88.89 %
5.MOVER HITS : 85.71 %
6.TARGETS NOT ENGAGED : 0 %

HITS : 100 %

Continued

CARE SYSTEM - CANADIAN ARMY TROPHY 1983 - CC 1983 GROUP LEOPARD

8 PLATOON ID-CODE : CTU53/32/3
 8 PLATOON COMMANDER :
 8 DTG : 101350JUN83
 8 SECTOR : -9-
 8 METEO : CLEAR/OVERCAST
 8 RUN/DAY : 4

ROUND	SEQ	SHOTS	TARGET	RANGE	3	2	3	4	5	SCORE
1	1	10	T1 L.	1800	14 R					725
			T2 .	1900	06 -	27 R				604
			T3 +.	1200	06 R	21 R				725
			T4 .	1300	04 +	05 R				750
			T5 .	1600	18 L	47 -				0
			T6 .	1450	07 R					900
	MOVE	2	4	T7 +.	1200	13 R	26 R			750
			T8 .	1250	08 R	09 R				875
2	3	8	T9 L.	1800	12 L	26 R	41 R			612
			T10 .	1600	09 R	34 R				548
			T11 .	1850	11 R					800
			T12 .	1850	07 R	25 R				900
		4	6	T13 .	1800	08 +	12 +			0
			T14 .	1850	07 R	31 R				900
			T15 .	1600	12 R					775
MOVE	5	5	T16 .	1500	14 R	32 R				725
			T17 .	1500	07 R	09 R				0
3	6	5	T18 .	1300	08 R					875
			T19 .	1600	08 R					875
			T20 .	1700	27 R					604
			T21 .	1400	14 R					725
			T22 .	1200	07 R					900
7	2	2	T23L.	1700	23 -					0
			T24R.	3100	10 R					825
TOTAL SCORE MAIN ARMAMENT										15793

REMARKS:

MG SCORE PER GROUP : A : 250
 B : 250
 C : 250
 D : 200
 E : 250
 F : 250
 G : 225
 H : 250
 TOTAL SCORE MG : 1725
 AMMUNITION BONUS : 0
 HIT BONUS : 0
 TOTAL PENALTIES : 0

TOTAL SCORE : 17718

1st Battle Run
Unit 3-32

GLOBAL RUN ANALYSIS

• PLATOON ID-CODE	: CTU63/J2/3
• PLATOON COMMANDER	: P
• DTG	: 101350JUN83
• SECTOR	: -
• METEO	: CLEAR/OVERCAST
• PLN/DAY	: 3

MAIN GUN : 1.ON BOUND : AVERAGE TIME FIRST SHOT : 10.9 S
AVERAGE TIME FIRST HIT : 13.5294118 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 85 %

2.MOVING : AVERAGE TIME FIRST SHOT : 10.5 S
AVERAGE TIME FIRST HIT : 11.6666667 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 75 %

3.TK-TARGETS NOT HIT : ENGAGEMENTS PLUS : 25 %
: ENGAGEMENTS MINUS : 25 %

4.FIXED TARGET HITS : 83.33 %

5.MOVER HITS : 83.33 %

6.TARGETS NOT ENGAGED : 0 %

ME : HITS : 96.25 %

Continued

CARE SYSTEM - CANADIAN ARMY TROPHY 1985 - (C) 1985 GROUP LEOPARD

• PLATOON ID-CODE : ETUS/3/32/1
 • PLATOON COMMANDER :
 • DTG : 121435JUN85
 • SECTOR : -4-
 • METEO : CLOUDY/RAIN
 • RUN/DAY : 3-3

ROUND	SEG	SHOTS	TARGET	RANGE	1	2	3	4	5	SCORE
1	1	10	T1	1400	07 R					700
			T2	2000	27 +	34 -	41 R			0
			T3	1450	03 -					0
			T4	1300	04 +	12 R				775
			T5	1900	06 R					725
			T6	1300	03 R	15 R				975
MOVE	2	7	T7	1200	03 R					975
			T8	1200	11 R	27 +				0
			T9	1800	05 R	31 +	44 R			750
			T10	1150	07 R	08 R	18 R			900
MOVE	3	4	T11	1250	07 -					0
			T12	1800	28 R					596
			T13	1250	18 R					676
			T14	1500	06 -	07 R	25 R			700
MOVE	5	4	T15	1600	05 R	27 L	29 +			750
			T16	1500	22 R					0
			T17	1500	13 R	14 R				750
			T18	1400	14 R					725
3	6	3	T19	1700	29 R					588
			T20	1300	06 R					725
			T21	1650	19 R					668
			T22	1300						0
7	4	4	T23	1700	16 -					0
			T24	1200	05 +	33 R				534
TOTAL SCORE MAIN ARMAMENT										13734

REMARKS:

MG SCORE PER GROUP :	A	250
	B	250
	C	150
	D	225
	E	250
	F	150
	G	250
	H	250
TOTAL SCORE MG :		1775
AMMUNITION BONUS :		0
HIT BONUS :		0
TOTAL PENALTIES :		600

TOTAL SCORE : 14909

2d Battle Run
Unit 3-32

GLOBAL RUN ANALYSIS

1 PLATOON ID-CODE	CTUB/3/32/1
2 PLATOON COMMANDER	
3 DTG	121435JUN82
4 SECTOR	
5 METEO	CLOUDY/RAIN
6 RUN/DAY	3

MAIN GUN : 1.ON BOUND : AVERAGE TIME FIRST SHOT : 11.31 S
AVERAGE TIME FIRST HIT : 14.75 S
ENGAGED TARGETS : 1 95 Z
HIT TARGETS : 1 80 Z

2. MOVING : AVERAGE TIME FIRST SHOT : 12.25 S
AVERAGE TIME FIRST HIT : 18 S
ENGAGED TARGETS : 1 100 Z
HIT TARGETS : 1 50 Z

3. TK-TARGETS NOT HIT : ENGAGEMENTS PLUS : 42.85 Z
ENGAGEMENTS MINUS : 35.71 Z

4. FIXED TARGET HITS : 03.33 Z

5. MOVER HITS : 1 50 Z

6. TARGETS NOT ENGAGED : 4.16 Z

75 : HITS : 86.75 Z

Continued

CARE SYSTEM - CANADIAN ARMY TROPHY 1965 - <C> 1965 GROUP LEOPARD

1 PLATOON ID-CODE : ETUE3/64/2
 1 PLATOON COMMANDER :
 1 DTG : 101025JUN65
 1 SECTOR : 4 -
 1 METEO : FOGGY
 1 RUN/DAY : 3 2

ROUND	SEG	SHOTS	TARGET	RANGE	1	2	3	4	5	SCORE
1	1	9	T1	1900	23 L					0
			T2	1450	03 -	26 8				612
			T3	1340	07 8					988
			T4	1300	04 8	17 8				763
			T5	2000	20 8					416
			T6	1800	06 8					725
			T7	1200	04 8					763
			T8	1200	04 8	24 8				763
MOVE	3	2	T9	1150	08 8					875
			T10	1250	05 8					750
			T11	1900	13 8	29 8				750
			T12	1850	05 L	25 8	40 8			620
			T13	1250	04 8					763
MOVE	4	10	T14	1800	19 R	36 8				580
			T15	1500	04 8	36 8				763
			T16	1500	05 8					750
			T17	1500	11 8					800
			T18	1700	14 8					725
3	6	5	T19	1400	02 8					988
			T20	1700	06 8					725
			T21	1400	07 L	23 8				636
			T22	1650	20 8	22 8				660
7	4	7	T23	1300	03 8					775
			T24	1600	03 8					775
TOTAL SCORE MAIN ARMAMENT										19321

REMARKS:

MG SCORE PER GROUP : A : 250

B : 250

C : 250

D : 250

E : 250

F : 250

G : 250

H : 250

TOTAL SCORE MG : 2000

AMMUNITION BONUS : 0

HIT BONUS : 0

TOTAL PENALTIES : 0

TOTAL SCORE : 21321

1st Battle Run
Unit 3-64

GLOBAL RUN ANALYSIS

PLATOON ID-CODE	: CT103/66/2
PLATOON COMMANDER	: 1
DTG	: 101033JUN83
SECTOR	: 1
METEO	: FOGGY
RUN'DAY	: 2

MAIN GUN : 1.ON BOUND : AVERAGE TIME FIRST SHOT : 8.35 S
AVERAGE TIME FIRST HIT : 11.47 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 93 %

2.MOVING : AVERAGE TIME FIRST SHOT : 7.25 S
AVERAGE TIME FIRST HIT : 7.25 S
ENGAGED TARGETS : 100 %
HIT TARGETS : 100 %

3..71.-TARGETS NOT HIT : ENGAGEMENTS PLUS : 0 %
: ENGAGEMENTS MINUS : 20 %

4.FIXED TARGET HITS : 94.44 %

5.MOVER HITS : 100 %

6.TARGETS NOT ENGAGED : 0 %

75 : HITS : 100 %

Continued

SE SYSTEM - CANADIAN ARMY TROPHY 1985 - <C> 1985 GROUP LEOPARD

1 PLATOON ID-CODE : ETU03/64/1
 2 PLATOON COMMANDER :
 3 DTB : 121135JUN85
 4 SECTOR : -
 5 METEO : CLOUDY
 6 TUN/FDAY : 3

ROUND	SHOTS	SHOTS	TARGET	RANGE	1	2	3	4	5	SCORE
1	4	4	T11	1200	04 S					963
			T12	1200	04 R					0
			T13	1000	03 L	07 S				850
2	4	4	T14	1450	03 S					975
			T15	1300	04 S					975
			T16	1300	03 S					975
			T17	1600	04 R					0
3	4	6	T18	1200	04 R	15 S				700
			T19	2150	03 S	06 S				950
4	4	6	T1101	1000	05 L	25 S				620
			T111	1050	03 S	19 R				975
			T112	1600	03 S	11 R				775
5	8	8	T113	1000	04 S					963
			T114	1050	04 S	22 R				963
			T115	1500	11 S					800
			T116	1600	01 S	10 S				1000
			T117	1250	07 S					900
			T118	1500	10 S					825
6	6	3	T119	1300	08 S	07 S				875
			T1201	1500	03 S					975
7	11	11	T21	1650	03 S	11 S				975
			T22	1700	03 S					975
			T23	1300	12 S	17 L	23 S	30 R		775
			T24	1400	01 S					1000
TOTAL SCORE MAIN ARMAMENT										19934

REMARKS:

MG SCORE PER GROUP : A : 250
 B : 250
 C : 250
 D : 250
 E : 250
 F : 250
 G : 250
 H : 250
 TOTAL SCORE MG : 2000
 AMMUNITION BONUS : 0
 HIT BONUS : 0
 TOTAL PENALTIES : 0

TOTAL SCORE : 21934

2d Battle Run
Unit 3-64

1 PLATOON 2D-CRDR 1 STAB/6472
2 PLATOON COMMANDER
3 ETC 121135JUN85
4 SECTOR 5
5 METED 6 CLOUDY
6 RUM/DAY 7 3

- MAIN ENR 1. ON BOUND : AVERAGE TIME FIRST SHOT : 4.0 S
AVERAGE TIME FIRST HIT : 4.22 S
ENGAGED TARGETS : 100 X
HIT TARGETS : 90 X
- 2. MOVING : AVERAGE TIME FIRST SHOT : 5 S
AVERAGE TIME FIRST HIT : 7.75 S
ENGAGED TARGETS : 100 X
HIT TARGETS : 70 X
- 3. TK-TARGETS NOT HIT : ENGAGEMENTS PLUS : 0 X
: ENGAGEMENTS MINUS : 0 X
- 4. FIXED TARGET HITS : 94.44 X
- 5. MOVER HITS : 83.33 X
- 6. TARGETS NOT ENGAGED : 0 X

16 8 HITS : 100 X

Continued

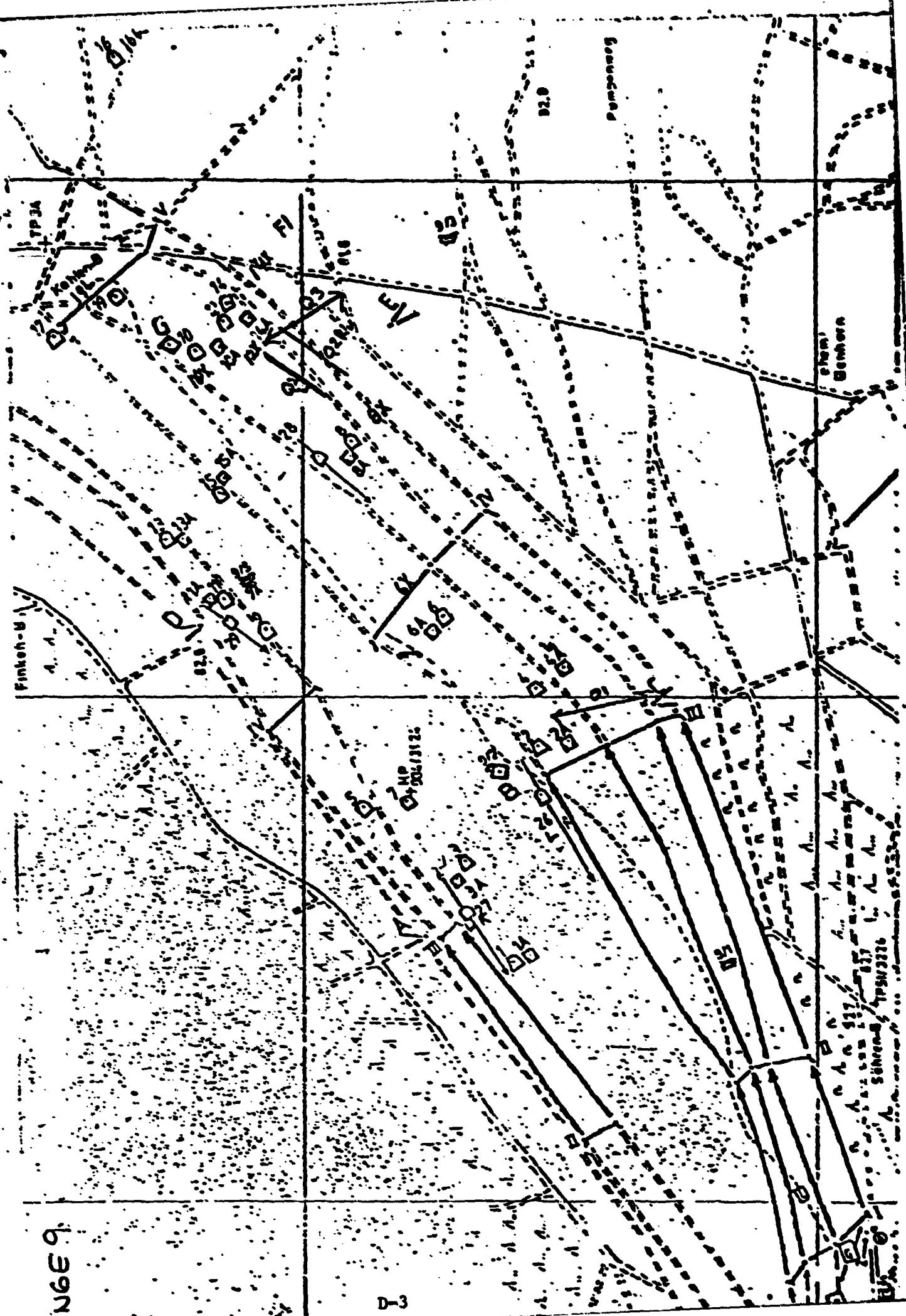
APPENDIX C

RAW DATA - CAT COMPETITION RESULTS FOR ALL CREWS

Unit	Platoon	Battle Run	Lane	Average Opening Time	Number of Hits	Number of Rounds Fired	Percent: Hits per Rounds Fired	Average Range
1	2	1	1	8.6	10	10	100.0	1560
1	2	1	1	15.0	10	10	100.0	1615
1	2	1	1	6.8	6	10	60.0	1435
1	2	1	1	10.0	10	10	100.0	1600
1	3	4	4	14.9	9	10	90.0	1561
1	3	3	3	13.2	10	10	100.0	1605
1	3	6	6	7.6	5	9	56.0	1486
1	3	5	5	3.0	7	10	70.0	1485
1	3	6	6	13.9	8	11	73.0	1536
1	3	5	5	9.0	8	10	80.0	1595
1	3	4	4	7.7	6	10	60.0	1545
1	3	3	3	10.6	4	9	44.0	1550
1	3	3	3	8.3	6	9	67.0	1500
2	2	3	2	3	4	7	9	78.0
2	2	3	2	12.4	4	7	9	1522
2	2	1	2	12.4	5	4	9	44.0
2	2	1	2	13.5	5	9	56.0	1556
2	2	6	6	13.6	5	9	56.0	1478
2	2	4	4	8.2	9	10	90.0	1535
2	2	5	5	13.5	4	9	44.0	1563
2	2	6	6	13.6	5	7	71.0	1679
2	2	4	4	8.2	8	8	100.0	1406
2	2	6	6	7.9	8	10	80.0	1644
2	2	3	3	11.8	5	7	71.0	1515
2	2	3	3	5	6.8	8	78.0	1525
2	2	1	1	4.7	4	7	60.0	1395
2	2	6	6	6.8	3	6	56.0	
2	2	5	5	6.2	2	9	9	
2	1	2	2	6.2	1	2	100.0	

NOTE: Unit 1 = Unit 2-66, Unit 2 = Unit 3-32, Unit 3 = Unit 3-64. See Table K.2 for summary measures.

APPENDIX D
BERGEN BOHNE RANGE MAP OF THE CAT COMPETITION



A 2669

D-3

APPENDIX E
SOLDIER INFORMATION SHEET

1. NAME: _____
Last _____ First _____ MI _____
2. SOCIAL SECURITY NUMBER: _____
3. DATE OF BIRTH: MONTH _____ YEAR _____
4. TIME IN THE MILITARY: MONTHS _____
5. PRESENT PAY GRADE: (E-1, E-2, etc.) _____
6. UNIT: _____
Div _____ Bn _____ Co _____ Plt/Sec _____ Crew _____
7. TIME IN YOUR PRESENT PAY GRADE: MONTHS _____
8. TIME IN YOUR PRESENT COMPANY: MONTHS _____
9. TIME IN YOUR PRESENT PLATOON/SECTION: MONTHS _____
10. TIME IN YOUR PRESENT CREW: MONTHS _____
11. SKILL LEVEL: (Example 10,20, etc.) _____
12. TIME IN YOUR PRIMARY MOS: MONTHS _____
13. HOW DID YOU EARN YOUR PRIMARY MOS: (Circle one.)
 - a. AIT/OSUT
 - b. On-the-job training (OJT)
 - c. Reclassified
 - d. Other (Specify) _____
14. WHAT IS YOUR PRESENT PRINCIPAL DUTY POSITION: (Circle one.)
 - a. Tank Commander
 - b. Gunner
 - c. Driver
 - d. Loader
15. HOW LONG HAVE YOU HELD YOUR PRESENT DUTY POSITION: MONTHS _____
16. HOW LONG HAVE YOU HELD YOUR POSITION IN THIS CREW: MONTHS _____

APPENDIX F
UCOFT TRAINING DATA

Table F.1

UCOFT Performance from First Training Period for Crews with TC/Gunner Pairs that Remained Intact

	Unit 2-66	Unit 3-32	Unit 3-64	Total
IDTM-COFT1 PRE-				
<u>M</u>	3.13	3.63	0.47	2.70
<u>SD</u>	1.41	1.42	0.06	1.70
<u>n</u>	7	4	3	14
IDTM2-COFT1 POST-				
<u>M</u>	1.51	2.25	0.17	1.43
<u>SD</u>	0.56	0.87	0.15	0.95
<u>n</u>	7	4	3	14
HITTM-COFT1 PRE-				
<u>M</u>	15.29	11.48	11.03	13.29
<u>SD</u>	1.05	1.34	1.63	2.38
<u>n</u>	7	4	3	14
HITTM2-COFT1 POST-				
<u>M</u>	13.40	10.88	5.59	11.01
<u>SD</u>	1.09	1.97	1.71	3.43
<u>n</u>	7	4	3	14
DHID-COFT1 PRE-				
<u>M</u>	12.16	7.85	10.57	10.59
<u>SD</u>	1.56	0.79	1.61	2.30
<u>n</u>	7	4	3	14
DHID2-COFT1 POST-				
<u>M</u>	11.89	8.53	5.43	9.55
<u>SD</u>	1.27	1.48	1.59	2.97
<u>n</u>	7	4	3	14

Table F.1 (continued)

UCOFT Performance from First Training Period for Crews with TC/Gunner Pairs that Remained Intact

	Unit 2-66	Unit 3-32	Unit 3-64
Total			
MGHTS-COFT1 PRE-			
<u>M</u>	6.15	4.28	5.00
<u>SD</u>	0.91	0.64	3.46
<u>n</u>	7	4	3
MGHTS2-COFT1 POST-			
<u>M</u>	7.35	5.33	7.00
<u>SD</u>	0.34	0.67	1.00
<u>n</u>	7	4	3
PHTSRDS-COFT1 PRE-			
<u>M</u>	80.02	67.70	56.00
<u>SD</u>	2.95	5.19	31.43
<u>n</u>	7	4	3
PHTSRDS2-COFT1 POST-			
<u>M</u>	84.26	76.98	89.00
<u>SD</u>	5.14	11.42	19.05
<u>n</u>	7	4	3

Table F.2

UCOFT Performance from Second Training Period for Crews with TC/Gunner Pairs that Remained Intact

	Unit 2-66	Unit 3-32	Unit 3-64	Total
IDTM3-COFT2 PRE-				
<u>M</u>	3.23	3.38	3.43	3.32
<u>SD</u>	0.89	0.84	1.27	0.89
<u>n</u>	7	4	3	14
IDTM4-COFT2 POST-				
<u>M</u>	1.91	1.89	1.70	1.86
<u>SD</u>	1.34	0.25	0.52	0.94
<u>n</u>	7	4	3	14
HITTM3-COFT2 PRE-				
<u>M</u>	10.50	11.29	8.18	10.23
<u>SD</u>	1.13	1.49	1.99	1.75
<u>n</u>	7	4	3	14
HITTM4-COFT2 POST-				
<u>M</u>	7.95	9.23	7.18	8.15
<u>SD</u>	2.82	1.91	1.65	2.35
<u>n</u>	7	4	3	14
DHID3-COFT2 PRE-				
<u>M</u>	7.28	7.91	4.74	6.92
<u>SD</u>	1.10	1.46	1.11	1.64
<u>n</u>	7	4	3	14
DHID4-COFT2 POST-				
<u>M</u>	6.14	7.34	5.48	6.34
<u>SD</u>	1.69	1.82	1.71	1.74
<u>n</u>	7	4	3	14

Table F.2 (continued)

UCOFT Performance from Second Training Period for Crews with TC/Gunner Pairs that Remained Intact

	Unit 2-66	Unit 3-32	Unit 3-64	Total
MGHTS3-COFT2 PRE-				
M	7.44	7.03	6.50	7.12
SD	0.45	0.64	0.43	0.61
n	7	4	3	14
MGHTS4-COFT2 POST-				
M	7.74	7.63	7.25	7.60
SD	0.47	0.25	0.66	0.47
n	7	4	3	14
PHTSRDS3-COFT2 PRE-				
M	85.11	79.25	74.67	81.20
SD	10.09	4.65	4.16	8.60
n	7	4	3	14
PHTSRDS4-COFT2 POST-				
M	86.59	85.00	80.00	84.72
SD	2.68	8.48	9.00	6.28
n	7	4	3	14

APPENDIX G

CORRELATIONS BETWEEN CAT PERFORMANCE VARIABLES AND UCOFT TRAINING DATA

Table G.1

Correlations between CAT Performance Measures and Pre-Post Measures from the First UCOFT Training Period

	NOHTS	NORDS	HTSRDS	AVHTTM
IDTM	-0.4318 (14) P= .062	.2062 (14) P= .240	-0.5281 (14) P= .026	-0.0591 (14) P= .421
HITTM	.2236 (14) P= .221	.1668 (14) P= .284	.1215 (14) P= .340	.0408 (14) P= .445
DHID	.5505 (14) P= .021	.0206 (14) P= .472	.5159 (14) P= .029	.0864 (14) P= .385
MGHTS	.0795 (14) P= .394	.0157 (14) P= .479	.0589 (14) P= .421	.1425 (14) P= .313
PHTSRDS	-0.0556 (14) P= .425	.2333 (14) P= .211	-0.1616 (14) P= .290	.2035 (14) P= .243
IDTM2	-0.1964 (14) P= .250	.6354 (14) P= .007	-0.4406 (14) P= .057	.1743 (14) P= .276
HITTM2	-0.0662 (14) P= .411	.5381 (14) P= .024	-0.3143 (14) P= .137	.1716 (14) P= .279
DHJD2	-0.0141 (14) P= .481	.3988 (14) P= .079	-0.2160 (14) P= .229	.1274 (14) P= .332
MGHTS2	.2987 (14) P= .150	-0.0662 (14) P= .411	.2983 (14) P= .150	-0.2498 (14) P= .195
PHTSRDS2	.0354 (14) P= .452	-0.3957 (14) P= .081	.1765 (14) P= .273	-0.1643 (14) P= .287

Table G.2

Correlations between CAT Performance Measures and Pre-Post Measures from the Second Training Period on UCOFT

	NOHTS	NORDS	HTSRDS	AVHTTM
IDTM3	.0160 (14) P= .478	.4243 (14) P= .065	-0.1423 (14) P= .314	-0.3269 (14) P= .127
HITTM3	-0.1139 (14) P= .349	.6043 (14) P= .011	-0.3612 (14) P= .102	.3873 (14) P= .086
DHID3	-0.1238 (14) P= .337	.4156 (14) P= .070	-0.3025 (14) P= .147	.5914 (14) P= .013
MGHTS3	-0.2241 (14) P= .221	.1113 (14) P= .352	-0.2924 (14) P= .155	.1439 (14) P= .312
PHTSRDS3	.0974 (14) P= .370	.3056 (14) P= .144	-0.0286 (14) P= .461	.0659 (14) P= .411
IDTM4	.1312 (14) P= .327	.2177 (14) P= .227	.0393 (14) P= .447	.3809 (14) P= .090
HITTM4	.3230 (14) P= .130	.4537 (14) P= .052	.1527 (14) P= .301	.6615 (14) P= .005
DHID4	.3442 (14) P= .114	.5058 (14) P= .032	.1602 (14) P= .292	.6366 (14) P= .007
MGHTS4	.4075 (14) P= .074	.5825 (14) P= .014	.1860 (14) P= .262	.2219 (14) P= .223
PHTSRDS4	.1700 (14) P= .281	.7520 (14) P= .001	-0.1198 (14) P= .342	.1071 (14) P= .358

APPENDIX H

'CORRELATIONS BETWEEN ASVAB SCORES AND CAT PERFORMANCE

Table H.1

Correlations between ASVAB Scores and CAT Performance Measures

	NOHTS	NORDS	HTSRDS	AVHTTM
TCGT	-0.2953 (16) P= .133	-0.4112 (16) P= .057	-0.1695 (16) P= .265	-0.1504 (16) P= .289
TCCO	-0.3129 (12) P= .161	-0.3252 (12) P= .151	-0.2362 (12) P= .230	-0.2101 (12) P= .256
TCST	-0.6246 (12) P= .015	-0.1169 (12) P= .359	-0.6570 (12) P= .010	-0.4790 (12) P= .058
TCAFQT	-0.3149 (16) P= .117	-0.1328 (16) P= .312	-0.2967 (16) P= .132	-0.2707 (16) P= .155
GNGT	.0752 (22) P= .370	-0.1599 (22) P= .239	.1389 (22) P= .269	.5594 (22) P= .003
GNCO	-0.0845 (22) P= .354	-0.1011 (22) P= .327	-0.0416 (22) P= .427	.4116 (22) P= .029
GNST	.0121 (22) P= .479	-0.0971 (22) P= .334	.0582 (22) P= .398	.3008 (22) P= .087
GNAFQT	.1125 (22) P= .309	-0.0344 (22) P= .440	.1345 (22) P= .275	.5321 (22) P= .005

Table H.2

Intercorrelations between Aptitude Area Scores on the ASVAB

	GNGT	GNCO	GNST	GNAFQT
TCGT	-0.2936 (15) P= .144	-0.4107 (15) P= .064	-0.2505 (15) P= .184	-0.3918 (15) P= .074
TCCO	-0.5776 (11) P= .031	-0.6406 (11) P= .017	-0.2722 (11) P= .209	-0.6500 (11) P= .015
TCST	-0.7555 (11) P= .004	-0.6662 (11) P= .013	-0.6060 (11) P= .024	-0.7453 (11) P= .004
TCAFQT	-0.5360 (15) P= .020	-0.6350 (15) P= .005	-0.5324 (15) P= .021	-0.5945 (15) P= .010

APPENDIX I
ASVAB SCORES ON INITIAL AND FINAL ROSTERS FOR CAT CREWS

Table I.1

Comparison of ASVAB Scores on Initial Roster and Final Roster for Tank Commanders

	Unit 2-66		Unit 3-32		Unit 3-64	
	2nd Plt	3rd Plt	3rd Plt	1st Plt	2nd Plt	1st Plt
<u>Tank Commander-GT Score</u>						
Initial Roster						
M	80.33	124.50	109.00	115.67	112.33	114.00
SD	17.89	30.41	7.07	10.02	11.68	8.72
n	3	2	2	3	3	3
Total						
M	98.00		113.00		113.17	
SD	31.25		8.72		9.26	
n	5		5		6	
Final Roster						
M	92.67	124.00	109.00	98.00	112.33	116.67
SD	14.47	31.11	7.07	20.88	11.67	12.06
n	3	.2	2	3	3	3
Total						
M	105.20		102.40		114.50	
SD	25.32		16.33		10.88	
n	5		5		6	
<u>Tank Commander-CO Score</u>						
Initial Roster						
M	93.00	130.00	97.50	113.00	104.50	121.67
SD	14.14	28.28	30.41	2.83	7.78	7.64
n	2	2	2	2	2	3
Total						
M	111.50		105.25		114.80	
SD	28.10		19.77		11.52	
n	4		4		5	
Final Roster						
M	99.00	130.00	97.50	111.00	104.50	119.33
SD	5.66	28.28	30.41	0.00	7.78	4.04
n	2	2	2	1	2	3
Total						
M	114.50		102.00		113.40	
SD	24.45		22.87		9.45	
n	4		3		5	

Table I.1 (continued)

Comparison of ASVAB Scores on Initial Roster and Final Roster for
Tank Commanders

	Unit 2-66		Unit 3-32		Unit 3-64	
	2nd Plt	3rd Plt	3rd Plt	1st Plt	2nd Plt	1st Plt
<u>Tank Commander-ST Score</u>						
<u>Initial Roster</u>						
<u>M</u>	84.33	125.50	104.00	108.00	99.00	117.67
<u>SD</u>	11.24	12.02	4.24	16.97	4.24	8.96
<u>n</u>	3	2	2	2	2	3
<u>Total</u>						
<u>M</u>	100.80		106.00		110.20	
<u>SD</u>	24.65		10.36		12.21	
<u>n</u>	5		4		5	
<u>Final Roster</u>						
<u>M</u>	92.50	125.50	104.00	120.00	99.00	118.67
<u>SD</u>	2.12	12.02	4.24	0.00	4.24	10.69
<u>n</u>	2	2	2	1	2	3
<u>Total</u>						
<u>M</u>	109.00		109.00		110.80	
<u>SD</u>	20.31		9.71		13.33	
<u>n</u>	4		3		5	
<u>Tank Commander-AFQT Score</u>						
<u>Initial Roster</u>						
<u>M</u>	36.33	74.50	47.00	64.67	48.00	73.33
<u>SD</u>	21.23	30.41	12.73	15.31	3.46	11.02
<u>n</u>	3	2	2	3	3	3
<u>Total</u>						
<u>M</u>	51.60		57.60		60.67	
<u>SD</u>	29.85		15.85		15.68	
<u>n</u>	5		5		6	
<u>Final Roster</u>						
<u>M</u>	50.00	74.50	47.00	51.33	48.00	79.00
<u>SD</u>	3.00	30.41	12.73	35.13	3.47	15.13
<u>n</u>	3	2	2	3	3	3
<u>Total</u>						
<u>M</u>	59.80		49.60		63.50	
<u>SD</u>	20.39		25.75		19.61	
<u>n</u>	5		5		6	

Table I.2

Comparison of ASVAB Scores on Initial Roster and Final Roster for Gunners

	Unit 2-66		Unit 3-32		Unit 3-64	
	2nd Plt	3rd Plt	3rd Plt	1st Plt	2nd Plt	1st Plt
<u>Gunner-GT Score</u>						
Initial Roster						
M	97.33	92.25	110.00	91.00	110.33	90.75
SD	8.02	17.33	13.66	12.41	15.04	4.35
n	3	4	4	4	3	4
Total						
M	94.43		100.50		99.14	
SD	13.38		15.78		13.95	
n	7		8		7	
Final Roster						
M	103.33	92.25	110.00	106.75	110.33	91.50
SD	17.62	17.33	13.66	16.58	15.04	6.14
n	3	4	4	4	3	4
Total						
M	97.00		108.38		99.57	
SD	16.99		14.17		13.99	
n	7		8		7	
<u>Gunner-CO Score</u>						
Initial Roster						
M	103.00	93.25	117.75	90.50	119.00	91.50
SD	8.89	11.35	18.08	9.26	17.87	11.68
n	3	4	4	4	3	4
Total						
M	97.43		104.13		103.29	
SD	10.86		19.72		19.19	
n	7		8		7	
Final Roster						
M	100.33	93.25	117.75	108.25	119.00	94.50
SD	4.51	11.35	18.08	14.01	15.87	9.11
n	3	4	4	4	3	4
Total						
M	96.29		113.00		105.00	
SD	9.25		15.81		17.23	
n	7		8		7	

Table I.2 (continued)

Comparison of ASVAB Scores on Initial Roster and Final Roster for Gunners

	Unit 2-66		Unit 3-32		Unit 3-64	
	2nd Plt	3rd Plt	3rd Plt	1st Plt	2nd Plt	1st Plt
<u>Gunner-ST Score</u>						
Initial Roster						
<u>M</u>	91.67	97.25	109.75	88.50	111.33	91.50
<u>SD</u>	4.16	3.40	11.95	12.48	10.21	7.19
<u>n</u>	3	4	4	4	3	4
Total						
<u>M</u>	94.86		99.13		100.00	
<u>SD</u>	4.53		16.03		13.15	
<u>n</u>	7		9		7	
Final Roster						
<u>M</u>	101.00	97.25	109.75	103.25	111.33	90.50
<u>SD</u>	19.29	3.40	11.95	20.65	10.21	9.75
<u>n</u>	3	4	4	4	3	4
Total						
<u>M</u>	98.86		106.50		99.43	
<u>SD</u>	11.57		16.00		14.36	
<u>n</u>	7		8		7	
<u>Gunner-AFQT Score</u>						
Initial Roster						
<u>M</u>	45.33	37.75	67.00	38.00	62.67	27.75
<u>SD</u>	6.11	21.33	26.82	23.04	21.22	8.66
<u>n</u>	3	4	4	4	3	4
Total						
<u>M</u>	41.00		52.50		42.71	
<u>SD</u>	16.01		27.86		23.15	
<u>n</u>	7		8		7	
Final Roster						
<u>M</u>	59.67	37.75	67.00	58.00	62.67	31.75
<u>SD</u>	30.66	21.33	26.82	25.46	21.22	5.91
<u>n</u>	3	4	4	4	3	4
Total						
<u>M</u>	47.71		62.50		45.00	
<u>SD</u>	26.51		24.68		20.99	
<u>n</u>	7		8		7	

APPENDIX J

CORRELATIONS BETWEEN CAT PERFORMANCE AND BIOGRAPHICAL VARIABLES

Table J.1

Correlations between CAT Performance Measures and Tank Commander Biographical Variables

	TCTM	TCTPG	TCTCO	TCTPL	TCTCR
NOHTS	-0.1260 (22) P= .288	-0.1688 (23) P= .221	.1691 (23) P= .220	.2793 (23) P= .098	.1015 (23) P= .322
NORDS	-0.3357 (22) P= .063	-0.2642 (23) P= .112	.1444 (23) P= .255	.0109 (23) P= .480	-0.1860 (23) P= .198
HTSRDS	-0.0049 (22) P= .491	-0.0940 (23) P= .335	.1278 (23) P= .281	.2924 (23) P= .088	.1833 (23) P= .201
AVHTTM	-0.2247 (22) P= .157	-0.0473 (23) P= .415	-0.2250 (23) P= .151	.1762 (23) P= .211	.2189 (23) P= .158
	TCTMOS	TCTDP	TCTDPC		
NOHTS	-0.3383 (21) P= .067	-0.1901 (23) P= .192	.4381 (23) P= .018		
NORDS	-0.0994 (21) P= .334	-0.0883 (23) P= .344	-0.0929 (23) P= .337		
HTSRDS	-0.3436 (21) P= .064	-0.1937 (23) P= .188	.5052 (23) P= .007		
AVHTTM	.0567 (21) P= .404	.0531 (23) P= .405	.0659 (23) P= .383		

Table J.2

Correlations between CAT Performance Measures and Gunner Biographical Variables

	GNTM	GNTPG	GNTCO	GNTPL	GNTCR
NOHTS	.2718 (22) P= .111	.5036 (22) P= .008	.3124 (22) P= .078	.1521 (22) P= .250	-0.1087 (22) P= .315
NORDS	-0.0210 (22) P= .463	.2936 (22) P= .092	.0529 (22) P= .408	-0.0886 (22) P= .348	-0.4909 (22) P= .010
HTSRDS	.3034 (22) P= .085	.4604 (22) P= .016	.3056 (22) P= .083	.1827 (22) P= .208	.0603 (22) P= .395
AVHTTM	-0.1152 (22) P= .305	-0.0946 (22) P= .338	.0952 (22) P= .337	.5123 (22) P= .007	.2281 (22) P= .154
	GNTMOS	GNTDP	GNTDPC		
NOHTS	-0.0400 (22) P= .430	.0765 (22) P= .367	-0.1467 (22) P= .257		
NORDS	.0484 (22) P= .415	.1049 (22) P= .321	-0.4595 (22) P= .016		
HTSRDS	-0.0369 (22) P= .435	.0569 (22) P= .401	.0100 (22) P= .482		
AVHTTM	-0.2299 (22) P= .152	-0.2803 (22) P= .103	-0.1518 (22) P= .250		

APPENDIX K
BIOGRAPHICAL DATA AND CAT PERFORMANCE FOR TOTAL CAT SAMPLE

Table K.1

Biographical Data by Unit and Platoon for Total CAT Sample

	Unit 2-66			Unit 3-32			Unit 3-64			Total
	2nd Plt.	3rd Plt.	Total	3rd Plt.	1st Plt.	Total	2nd Plt.	1st Plt.	Total	
Tank Commander-Time in Military										
M	98.75	78.25	88.50	103.25	89.00	97.14	122.00	105.00	112.29	
SD	55.90	41.18	46.75	57.43	73.74	59.33	21.07	64.53	48.09	
n	4	4	8	4	3	7	3	4	7	
Tank Commander-Time in Pay Grade										
M	30.00	19.00	24.50	38.75	40.00	39.38	48.00	31.50	38.57	
SD	28.75	15.43	22.16	25.49	27.12	24.37	12.00	22.65	19.55	
n	4	4	8	4	4	8	3	4	7	
Tank Commander-Time in Company										
M	27.75	49.25	38.50	12.25	13.00	12.63	16.00	12.50	14.00	
SD	16.94	39.18	30.21	6.56	5.23	5.50	8.72	4.12	6.11	
n	4	4	8	4	4	8	3	4	7	
Tank Commander-Time in Platoon										
M	11.75	18.75	15.25	8.00	13.00	10.50	13.00	7.50	9.86	
SD	5.50	12.53	9.71	2.16	5.23	4.57	3.61	5.45	5.27	
n	4	4	8	4	4	8	3	4	7	

Note. All time is in months.

Table K.1 (continued)
 Biographical Data by Unit and Platoon for Total CAT Sample

	Unit 2-66						Unit 3-32						Unit 3-64					
	2nd Plt.			3rd Plt.			Total			1st Plt.			2nd Plt.			1st Plt.		
	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n
Tank Commander-Time in Crew																		
M	9.00	13.25	11.13	8.00	20.50	14.25	12.33	10.25	11.14									
SD	0.00	7.18	5.22	2.16	18.77	14.06	2.52	3.50	3.08									
n	4	4	8	4	4	8	3	4	7									
Tank Commander-Time in MOS																		
M	13.33	14.67	14.00	103.25	63.75	83.50	37.00	39.00	38.14									
SD	0.58	4.62	3.03	57.43	37.08	49.48	24.06	33.05	27.21									
n	3	3	6	4	4	8	3	4	7									
Tank Commander-Time in Duty Position																		
M	13.25	34.00	23.63	49.25	32.75	41.00	50.67	13.75	29.57									
SD	4.79	24.81	19.91	50.34	17.61	36.01	34.95	4.65	28.41									
n	4	4	8	4	4	8	3	4	7									
Tank Commander-Time in Duty Position with Crew																		
M	13.25	13.75	13.50	8.00	10.75	9.38	13.00	10.25	11.43									
SD	4.97	5.91	4.99	2.16	4.19	3.42	3.61	3.50	3.55									
n	4	4	8	4	4	8	3	4	7									

Note. All time is in months.

Table K.1 (continued)
Biographical Data by Unit and Platoon for Total CAT Sample

	Unit 2-66			Unit 3-32			Unit 3-64		
	2nd Plt.	3rd Plt.	Total	3rd Plt.	1st Plt.	Total	2nd Plt.	1st Plt.	Total
Gunner-Time in Military									
M	59.25	50.00	54.63	60.25	27.50	49.33	62.25	46.50	54.38
SD	14.99	12.57	13.73	21.45	17.68	24.99	20.40	17.06	19.34
n	4	4	8	4	2	6	4	4	8
Gunner-Time in Pay Grade									
M	25.25	8.50	16.88	16.25	7.00	13.17	20.75	15.75	18.25
SD	15.52	4.51	13.86	12.66	6.00	10.91	11.29	14.15	12.15
n	4	4	8	4	2	6	4	4	8
Gunner-Time in Company									
M	30.25	29.75	30.00	12.00	14.50	12.83	14.50	12.50	13.50
SD	24.81	12.34	18.14	6.73	4.95	5.81	3.97	9.00	6.48
n	4	4	8	4	2	6	4	4	8
Gunner-Time in Platoon									
M	12.00	18.75	15.38	11.50	6.00	9.67	11.75	5.75	8.75
SD	6.00	16.96	12.32	7.19	7.07	7.00	6.24	3.30	5.63
n	4	4	8	4	2	6	4	4	8
Gunner-Time in Crew									
M	9.50	7.75	8.63	8.50	6.00	7.67	11.25	5.75	8.50
SD	1.00	2.63	2.07	1.91	7.07	3.72	5.38	3.30	5.07
n	4	4	8	4	2	6	4	4	8

Note. All time is in months.

Table K.1 (continued)

Biographical Data by Unit and Platoon for Total CAT Sample

	Unit 2-66			Unit 3-32			Unit 3-64		
	2nd Plt.	3rd Plt.	Total	3rd Plt.	1st Plt.	Total	2nd Plt.	1st Plt.	Total
Gunner-Time in MOS									
M	13.00	13.25	13.13	60.25	27.50	49.33	36.50	44.25	40.38
SD	0.00	0.96	0.64	21.45	17.68	24.99	12.04	18.87	15.23
n	4	4	8	4	2	6	4	4	8
Gunner-Time in Duty Position									
M	33.25	10.75	22.00	30.00	14.50	24.83	26.25	36.00	31.13
SD	14.64	4.27	15.63	11.19	13.44	13.24	11.95	24.00	18.31
n	4	4	8	4	2	6	4	4	8
Gunner-Time in Duty Position with Crew									
M	9.50	8.75	9.13	8.50	3.00	6.67	11.25	11.25	11.25
SD	1.00	4.11	2.80	1.91	2.83	3.44	5.38	9.63	7.23
n	4	4	8	4	2	6	4	4	8

Note. All time is in months.

Table K.2

CAT Performance Measures by Unit and Platoon for Total CAT Sample

	Unit 2-66			Unit 3-32			Unit 3-64			Total
	2nd Plt.	3rd Plt.	Total	3rd Plt.	1st Plt.	Total	2nd Plt.	1st Plt.	Total	
Average Opening Time (seconds)										
\bar{M}	10.10	9.68	9.89	10.30	11.95	11.13	8.68	4.85	6.76	
\bar{SD}	3.52	5.43	4.24	2.68	2.49	2.55	2.17	1.11	2.59	
\bar{n}	4	4	8	4	4	8	4	4	8	
Number of Hits										
\bar{M}	9.00	7.75	8.38	6.50	5.50	6.00	7.50	6.75	7.13	
\bar{SD}	2.00	2.22	2.07	1.91	1.29	1.60	1.73	1.71	1.64	
\bar{n}	4	4	8	4	4	8	4	4	8	
Number of Rounds Fired										
\bar{M}	10.00	9.75	9.88	10.00	9.00	9.50	8.75	9.25	9.00	
\bar{SD}	0.00	0.50	0.35	0.82	0.00	0.76	1.50	0.50	1.07	
\bar{n}	4	4	8	4	4	8	4	4	8	
Percent: Hits per Rounds Fired										
\bar{M}	90.00	79.00	84.50	64.25	61.25	62.75	85.25	73.50	79.38	
\bar{SD}	20.00	19.77	19.32	15.84	14.59	14.19	12.53	20.09	16.72	
\bar{n}	4	4	8	4	4	8	4	4	8	
Average Range of Targets (meters)										
\bar{M}	1552.50	1533.50	1543.00	1556.50	1514.00	1535.25	1546.25	1519.75	1533.00	
\bar{SD}	81.70	59.92	67.10	26.31	33.27	35.88	112.21	101.74	100.16	
\bar{n}	4	4	8	4	4	8	4	4	8	

APPENDIX L

VARIABLE CODE NAMES FOR ALL VARIABLES USED IN THE ANALYSES

UCOFT PERFORMANCE VARIABLES:

ITDM	Target Identification Time-Pretest, First Training Period to UCOFT
HITTM	Target Hit Time-Pretest, First Training Period to UCOFT
DHID	Target Hit Time minus Target ID Time-Pretest, First Training Period to UCOFT
MGHTS	Main Gun Hits-Pretest, First Training Period to UCOFT
PHTSRDS	Percent: Hits per Rounds Fired-Pretest, First Training Period to UCOFT
IDTM2	Target Identification Time-Posttest, First Training Period to UCOFT
HITTM2	Target Hit Time-Posttest, First Training Period to UCOFT
DHID2	Target Hit Time minus Target ID Time-Posttest, First Training Period to UCOFT
MGHTS2	Main Gun Hits-Posttest, First Training Period to UCOFT
PHTSRDS2	Percent: Hits per Rounds Fired-Posttest, First Training Period to UCOFT
IDTM3	Target Identification Time-Pretest, Second Training Period to UCOFT
HITTM3	Target Hit Time-Pretest, Second Training Period to UCOFT
DHID3	Target Hit Time minus Target ID Time-Pretest, Second Training Period to UCOFT
MGHTS3	Main Gun Hits-Pretest, Second Training Period to UCOFT
PHTSRDS3	Percent: Hits per Rounds Fired-Pretest, Second Training Period to UCOFT
IDTM4	Target Identification Time-Posttest, Second Training Period to UCOFT
HITTM4	Target Hit Time-Posttest, Second Training Period to UCOFT
DHID4	Target Hit Time minus Target ID Time-Posttest, Second Training Period to UCOFT

MGHTS4 Main Gun Hits-Posttest, Second Training Period to UCOFT
PHTSRDS4 Percent: Hits per Rounds Fired-Posttest, Second Training Period to UCOFT

CAT Performance Variables:

NOHTS Number of Target Hits
NORDS Number of Rounds Fired
HTSRDS Percent: Hits per Rounds Fired
AVHTTM Average Opening Time

ASVAB Scores:

TCGT Tank Commander-GT Score
TCCO Tank Commander-CO Score
TCST Tank Commander-ST Score
TCAFQT Tank Commander-AFQT Score
GNGT Gunner-GT Score
GNCO Gunner-CO Score
GNST Gunner-ST Score
GNAFQT Gunner-AFQT Score

BIOGRAPHICAL Variables

TCTM Tank Commander - Total Time in Military (months)
TCTPG Tank Commander Time in Pay Grade (months)
TCTCO Tank Commander - Time in Company (months)
TCTPL Tank Commander - Time in Platoon (months)
TCTCR Tank Commander - Time in Crew (months)
TCTMOS Tank Commander - Time in MOS (months)
TCTDP Tank Commander - Time in Duty Position (months)

TCTDPC	Tank Commander - Time in Duty Position with Crew (months)
GNTM	Gunner - Total Time in Military (months)
GNTPG	Gunner - Time in Pay Grade (months)
GNTCO	Gunner - Time in Company (months)
GNTPL	Gunner - Time in Platoon (months)
GNTCR	Gunner - Time in Crew (months)
GNTMOS	Gunner - Time in MOS (months)
GNTDP	Gunner - Time in Duty Position (months)
GNTDPC	Gunner - Time in Duty Position with Crew (months)

APPENDIX M
RESULTS OF 1985 CAT COMPETITION

Table M.1

CAT Scores by Army Group

	TOTAL POINTS
CENTAG	185,656
NORTHAG	190,755

Table M.2

CAT Scores by Country

	TOTAL POINTS
Germany (1 Units)	120,922
US (3 Units)	116,528
Netherlands (1 Unit)	41,278
Belgium (1 Unit)	35,816
Canada (1 Unit)	28,474